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Green Building Transitions

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Abbreviations

BC	British Columbia
BCC	Brisbane City Council
BHC	Brisbane Housing Company
BREEAM	Building Research Establishment Environmental Assessment Methodology
CAGBC	Canada Green Building Council
CBD	Central Business District
CCP	Cities for Climate Change Protection
CDEC	Council for the Economic Development of Construction (Luxembourg)
CIRS	Centre for Interactive Research on Sustainability
COAG	Council of Australian Governments
COP23	2017 United Nations Climate Change Conference
CNCD	National Council for Sustainable Construction (Luxembourg)
DFG	German Research Foundation
DGNB	German Sustainable Building Council
EU	European Union
FNR	National Research Fund (Luxembourg)
FR-LEH	Freiburg Low-Energy House
FSB	Freiburger Stadtbau GmbH
FWTM	Freiburg Business, Tourism and Trade Enterprise
GBCA	Green Building Council Australia
GCAP	Greenest City 2020 Action Plan
HQE	High Environmental Quality
ISE	(Fraunhofer) Institute for Solar Energy Systems
ICLEI	Local Governments for Sustainability
ISES	International Solar Energy Society
KfW	Reconstruction Credit Institute
LEED	Leadership in Energy and Environmental Design
LENOZ	Sustainability Certificate for Residential Buildings in Luxembourg (Lëtzebuerger Nohaltegkeets-Zertifizéierung)
MaP	Multi-Actor Perspective

MLP	Multi-Level Perspective
NGO	Non-Government Organisation
OV	Olympic Village
PAR	Participatory Action Research
PCA	Property Council of Australia
PV	Photovoltaics
SEEDS	Social Ecological Economic Development Studies
SEFC	Southeast False Creek
SEQ	South East Queensland
SEQROC	South East Queensland Region of Organisation of Councils
SME	Small and Medium-Sized Enterprise
SNM	Strategic Niche Management
SST	Social Studies of Technology
SUSI	Self-Organised Independent Housing Initiative
TEAM	The Electors Action Movement
UBC	University of British Columbia
UK	United Kingdom
UN	United Nations
UNCHE	United Nations Conference on the Human Environment
UQ	University of Queensland
US	United States of America
USI	University of British Columbia Sustainability Initiative
WGBU	German Advisory Council on Global Change

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Part I
Framing Urban Green Building

Chapter 1
Green Building as Urban Climate Change Strategy

Julia Affolderbach, Boris Braun, and Christian Schulz

Abstract The building sector has been identified as one of the largest contributors to human-related greenhouse gas emissions but also as one holding great potential to lower its emissions. Due to the concentration of built structures in urban areas, green building has become a major part of urban climate change strategies, but approaches differ considerably. This book discusses local pathways to green building in four selected city regions: Freiburg in Germany, Vancouver in Canada, Brisbane in Australia and Luxembourg City in Luxembourg. The four case studies illustrate both similarities and differences through which green building is realised. The work presented identifies different forms of urban green building that range from experimental building designs and technologies and retrofitted building stock to newly designed neighbourhoods and from policies and regulatory tools to new institutional arrangements and actors. It captures not only endeavours to reduce the carbon footprint of buildings and their associated uses but also considers the wider context and social dimensions of sustainability such as ideas of liveability and affordability. It considers the conditions that foster and promote green building but also factors that inhibit its realisation and critically examines the success and changes over time within the four case studies in order to contribute to ongoing debates around urban sustainability transitions.

1.1 Introduction

In November 2017, shortly after the US government resigned from the Paris agreement, the United Nations Climate Change Conference (COP23) was held in Bonn, Germany. Despite the US government's withdrawal, the conference saw American delegations, but they did not represent the national government. The two initiatives *We are still in* and *America's Pledge* in particular drew a large number of subnational authorities and non-governmental organisations (NGOs) from the United

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States who demonstrated their strong commitments to the Paris goals. Not surprisingly, cities, city regions and city networks were central to these initiatives. These positions and initiatives are increasingly driven by the realisation that a reduction in carbon emissions requires fundamental change to our current socio-economic system. Cities have been identified as optimum scale to address climate change within policy and academic circles due to their high share of global greenhouse gas emissions but also in terms of the relatively close link between municipal governments and their constituencies, the relatively strong authority local governments have over a broad range of sectors as well as high(er) levels of civil mobilisation and activism (e.g. Bulkeley 2013). While these are all arguments favouring the urban scale, the extent to which cities have taken climate change action varies significantly within and across countries as does their success in promoting greening at the local scale.

Climate change actions by cities have been described and promoted as urban sustainability transitions to emphasise the extent of change needed to achieve green, sustainable and low-carbon futures (Bulkeley et al. 2011). Urban sustainability transitions help identify, conceptualise and categorise pathways to low-carbon and more sustainable societies within cities. Work has primarily focused on identifying drivers and barriers to regional and urban low-carbon transitions (Bulkeley et al. 2011; Rutherford and Coutard 2014) with a strong focus on the provision of infrastructure including transportation and energy (Rohracher and Späth 2014; Emelianoff 2014; McCauley and Stephens 2012). The building sector is one of the largest contributors to human-related greenhouse gas emissions but also one holding great potential to lower emissions due to the availability of technologies and opportunity for innovation related to new constructions, retrofitting of existing buildings and a more general shift to green energy supply and demand (UNEP 2011). The interest and literature on urban transitions and green building are growing quickly featuring work on green cities and eco-districts as well as on ecopreneurs and Eco-Homes (Gibbs and O'Neill 2014; Dixon et al. 2014; Frantzeskaki et al. 2017; Loorbach et al. 2016; van der Heijden 2014a, b; O'Neill and Gibbs 2014; Pickerill 2017).

One example of green building is the City of Freiburg in southwest Germany that has gained prominence during the 1990s through its Vauban neighbourhood development. In the early 1990s, the City of Freiburg decided to redevelop a former military barracks site located in the southern part of the city into the new eco-district of Vauban. Vauban was planned to provide homes to 5300 residents which were realised over a period of almost 15 years (Freytag et al. 2014). While the development was a response to growing population pressures on the residential market, the neighbourhood development was also guided by a number of sustainability principles including citizen participation, strict sustainable building standards enforced through Freiburg's very strict building codes and a transportation strategy based on alternative modes of transportation. These grew out of a local context of high levels of public participation and social mobilisation around environmental issues paired with a high demand for green energy. The most striking feature of Vauban is its solar settlement that consists of 59 housing units that were built as plus-energy neighbourhood that generates a surplus through the solar panels installed on the buildings' roofs (Fig. 1.1). Vauban also publicised the idea of building groups (Baugruppen) which have shaped parts of the neighbourhood not only through its

Fig. 1.1 The Solar Settlement in Vauban, Freiburg (Photo: Sebastian Fastenrath)

visual design but also providing strong social networks for residents. These building groups consist of individuals and families (self-builders) who form a collaborative to jointly design and develop plans for their building block usually with support of a hired architect and/or builder. Many of Vauban's building groups have voluntarily adopted passive house standards for their blocks going beyond legislated standards. Vauban as such is a green neighbourhood that has been shaped by the visions and actions of its residents not only through building groups but also through broader public consultation processes. Vauban was showcased as an example of best practice at the United Nations (UN) Habitat Conference in Istanbul in 1996 and has attracted international interest ever since making it one of the world's models for green eco-districts comparable to Hammarby Sjöstad in Stockholm and BedZED in London. It now serves as an example of success of green building and green neighbourhood development around the world attracting large numbers of professionals who visit the district for inspiration, learning and exchange.

Green building encompasses a vast array of activities related to the conception, planning and operation of buildings that make their construction and use more sustainable. This involves factors and measures leading to higher resource and energy efficiencies, to healthier work and living environments contributing to the well-being of users and residents as well as to a better functional integration into the built environment and its infrastructure, in particular regarding aspects of mobility and accessibility. Innovations and change in the building sector towards green building as covered in this book link to a number of discussions in the literature. Green building is probably mostly associated with physical buildings that feature green technologies and design options to reduce the ecological footprint. A lot of attention has

been paid to green and smart technologies including alternative building materials, energy saving and alternative energy sources including district energy, low-carbon or energy-plus houses, changes in conceptions of living space such as reduced unit sizes and shared facilities but also building design (e.g. through increased use of natural light) and urban design, i.e. the ways in which buildings interact with their environment and users. These innovations are frequently tested through building experiments such as the solar settlement in Vauban, Freiburg, or the BedZED building in London. The example of Vauban illustrates the opportunities to reduce carbon emissions through green building but also shows that green building is not restricted to green technologies such as alternative energy including solar panels and changes to building design but includes new organisational forms as illustrated by Freiburg's building groups and holistic approaches to neighbourhood development through integrated alternative transportation planning. Governance processes and policy analysis are central tools to understanding aspects of urban planning, design, regulation and stakeholder engagement and to identifying successful models and best practices. Green building also includes mechanisms that promote and support the implementation of green building innovations including green policies, regulations and standards (e.g. Freiburg's strict energy standards), support mechanisms providing know-how, financial tools and other relevant resources. These may take the form of new institutional organisations from certification bodies and neighbourhood organisations to research institutes as well as the restructuring of existing systems. Green building initiatives involve not only government stakeholders but also non-profit and private sector actors (e.g. BedZED, Bioregional, the Architecture 2030 programme). Finally, social and cultural norms, beliefs and habits shape expectations and standards of living (e.g. floor space, open living) and the way people interact and use the built environment. Despite green technologies and design, the success of a green building is ultimately defined by its users (e.g. Pickerill 2015). Similarly, performativity and the way people embody, envision and communicate green vision can impact the success of green innovations (Cidell 2015). This links to ideas of social innovations and organisational and institutional innovations (Seyfang and Smith 2007). Green building as it is discussed in this book encompasses all of these dimensions.

1.2 Cities, Climate Change and Green Building

Sustainable or green cities have become a common political objective and policy goal. Cities contribute a proportionally high share of greenhouse gas emissions compared to non-urban areas. They account for 60–80% of energy consumption and over 75% of natural resource consumption and emit 75% of global carbon emissions. And the numbers are expected to continue to rise. Estimates suggest that by 2030, over 80% of global annual energy demand will come from cities. Buildings are one of the biggest contributors to (urban) greenhouse gas emissions. Approximately 30–40% of final energy consumption is used by buildings

(Pérez-Lombard et al. 2008). But as much as buildings and cities contribute to greenhouse gas emissions, they are seen as a central part of the solution to our climate crisis (van der Heijden 2014a; Roaf et al. 2009).

Most cities are facing a number of challenges that force them to actively confront climate change including population growth that exerts pressures on already strained urban infrastructure and services as well as an increase in the total of carbon emissions. While cities are powerful in economic terms, they are also vulnerable places that are particularly hard hit by the implications of climate change. As a result, there has been a surge in urban climate change initiatives and leadership over the past few decades. While global and national positioning on climate change action has been relatively slow, decision-makers at the local scale have stepped up and taken on climate change leadership. An increasing number of cities have started to act as climate change leaders setting ambitious carbon emission reduction targets and developing a wide range of strategies to achieve these targets including low-carbon and green infrastructure and services. Some of them are now prominent examples of green leadership with cities like Copenhagen, Amsterdam, Singapore and Portland scoring high in global city rankings. Urban greening and climate change initiatives are frequently seen as bottom-up processes that are driven by local institutions and actors rather than expressions of top-down implementations of higher-scale regulations. This is, for example, illustrated by the position a number of American cities have taken in response to President Donald Trump's decision to withdraw the United States from the Paris accord. New York City, Miami and San Francisco amongst others have spoken up in support of the Paris accord commitments and are backed up internationally by cities through alliances such as the Global Covenant of Mayors. The growth of institutionalised networks from Local Governments for Sustainability (ICLEI) and the C40 Cities Climate Leadership Group to more recent initiative such as the Compact of Mayors, Covenant of Mayors and STAR Communities in the United States illustrates the surge in city initiatives. Cities can thus be understood as arenas for transition-oriented innovations that seek to transform urban systems fundamentally.

A significant amount of research depicts cities consisting of various governance arrangements involving municipal and higher-level governments, private sector organisations and civil society as key actors in addressing and mitigating climate change. This focus on cities is linked to the role of actors and scale. Municipal authorities have responsibility for many processes that shape urban vulnerabilities and affect greenhouse gas emissions at the local level including urban planning, building codes, provision of transportation and other infrastructures (e.g. energy, water, waste). But most of these processes are also governed or influenced by cross-municipal decision-making and regional, national and international frameworks and visions (e.g. EU regulations). Most municipalities in the Global North including the ones examined in this book hold a democratic mandate from the public to address issues that affect the city and hence are much more closely and directly linked to their constituency in contrast to regional or national governments (Bulkeley 2013). This is often linked to the idea of locally developed, endorsed and implemented solutions. Some cities have responded early to sustainability challenges and climate

change including the cities of Freiburg and Vancouver that now strongly promote their long experience.

Cities are also seen as *laboratories* for testing innovative approaches to mitigate climate change. They hold significant resources to drive transition processes, for example, through universities, research and development centres and cultural institutions (Evans 2011; König 2013; Evans and Karvonen 2014). As a result, innovation and entrepreneurship are much higher in cities than in less densely populated regions, and increased emphasis has been placed on the private sector providing climate change solutions whether this involves locally grown businesses or large external companies (Acs 2003; Carlino et al. 2007). Municipalities also act as partners for private and civil society actors who are often concentrated in cities and have shown growing commitment to taking climate change action. But change is also driven by public environmental concern, and cities provide effective arenas for civil society to mobilise support. The latter may profit from the fact that bigger cities often have a higher share of inhabitants sensible to these issues. Ultimately, buildings are only as sustainable and carbon intensive as their users. How green concepts, technologies and designs are put into practice and are lived out in the lives of ordinary citizens depends on how people use and interact with their work and living environments including single edifices, ensembles or neighbourhoods of residential and commercial buildings.

1.3 Green Building Transitions

Cities face their individual challenges, operate under different framework conditions and contexts, employ different strategies with varying degrees of success and have specific abilities and resources to do so. In order to identify and reconstruct urban trajectories of green building, these context conditions together with the actors as agents of change require careful consideration. The approach used in this book is informed by work on sustainability or low-carbon transitions (Bulkeley et al. 2011; Rohracher and Späth 2014; Rutherford and Coutard 2014; Wolfram 2016) that draws on transition studies thinking and more specifically a multi-level perspective. It also brings in work on policy mobility that raises questions of how ideas, knowledge and innovations travel and are transferred, adapted and adopted across space (Affolderbach and Schulz 2016).

The notion of *transition* highlights the process dimension under consideration, meaning a change that is happening over a longer time period. It also signals a change that is more radical and fundamental than those associated with other concepts as, for example, sustainable development. Work in transition studies and sustainability transitions focuses on the emergence and implementation of predominantly technological innovations that bring about far-reaching changes to existing production and consumption systems. While some earlier work in the field of transition studies has focused on historical examples of radical innovations, a dominant theme in transition studies relates to its application in respect to low-carbon

or sustainability transitions that seek to identify drivers behind (and to a much smaller extent barriers to) greening processes. Technological innovations are key to this conceptual approach, but they are understood as products of socio-technical dynamics. One approach to analyse and understand these socio-technical dynamics is the multi-level perspective (MLP) that differentiates the societal context of innovations into three different levels: the landscape, regime and niche level. The logic of the MLP relies on the realisation that change is often hard to implement and the different levels provide different barriers and contexts to change. The niche level is seen as the immediate nurturing environment that allows innovations to blossom. Niches may consist of legally or otherwise protected spaces that allow experimentations outside of the rules of the market or emerge where knowledge networks are particularly dense (e.g. collaboration between the higher education sector, other research institutions and the private sector). These niches never exist in isolation but are embedded in *socio-technical regimes* (Smith 2007) which are defined by predominant organisational standards (e.g. building regulations). The highest landscape level describes broader societal values, norms and standards that may include the predominant position on energy sources and environmental consciousness amongst the public. In order for green building innovations to have a wider impact, they need to spill over and promote change at these broader levels.

From a transition studies perspective, niches, regimes and landscapes do not correspond to specific spatial scales. In fact, transition studies do not engage with spatial conceptions and dimensions of niche development. But niches are spatial expressions that allow the emergence of green building as illustrated in this book for Freiburg, Vancouver, Brisbane and Luxembourg. City regions could be understood as niches that provide a test bed or laboratory for the development of green building experiments and innovations. At the same time, cities are not homogenous but may be rather uneven spaces that consist of a mosaic of different niches as illustrated by experimental green neighbourhood developments such as Vauban in Freiburg. Innovative approaches to green building through regulatory frameworks and governance provide further examples of niche initiatives including green policies and regulations such as Freiburg's green building codes, certification schemes such as Leadership in Energy and Environmental Design (LEED) in North America and Green Star in Australia or specific institutions dedicated to advance green building both in research and development and implementation.

While the MLP provides a structured heuristic to analyse green building transitions, it runs the risk to neglect or disregard important dimensions of urban transition processes (Affolderbach and Schulz 2016). Firstly, it is at least in its origin technocentric reducing green transitions to technology-driven processes that neglect very important policy, institutional, organisational and other social innovations. As such, it focuses on a narrow understanding of knowledge creation. Secondly, the idea of radical niche innovations simplifies complex processes of exchange and interaction between various actors which involve learning, adaptation and mutation of ideas. Thirdly, transition research is focused on the local, regional or national level but ignores connections and flows between these scales. Finally, transition studies understand innovations through institutional structures and actor networks

but neglect the role of individuals. A policy mobility perspective helps to address these limitations. Innovations result from processes of knowledge creation and learning. The policy mobility perspective focuses on these processes to understand how cities learn about urban policy innovations and how ideas, practices and models circulate, travel and become implemented in different places (McCann and Ward 2010, 2011). In particular, it involves analysis of those involved in policy mobility including key actors, how and what they learn and what happens to knowledge, ideas and practices when they travel. On the one hand, the (geographic) literature emphasises the relevance of the local context in respect to urban development consisting of context-specific, localised processes of putting green (building) strategies into practice. On the other hand, urban geography scholars argue that local strategies and practices are being *debordered* as models, knowledge, practices and successes as well as stories of failure are being transferred, circulated and shared internationally and globally (Peck and Theodore 2010) turning cities into assemblages of pieces, ideas and practices from elsewhere (McFarlane 2011). In this book, cities and city regions are understood as relational spaces that are as much shaped by their intrinsic natural environment, political climate and level of autonomy as by external influences and relations across space. They are not just local or urban. It is these connections and causalities that are being presented here using micro or niche case studies for each of the four cities.

1.4 Objectives of the Book

The central questions addressed in this book revolve around why some cities innovate and engage in broader transitions towards green building while others struggle, resist or fail. What are the context and circumstances that drive cities to take action? Where do innovations in green building come from and what are the conditions needed to foster their emergence and spread? The objectives of the book are twofold. First, the book aims at providing empirical evidence from in-depth case study research towards an increased understanding of how innovations towards low-carbon economies in the building sector come into being and have developed over time in different geographical contexts. Green building innovations include both newly developed as well as adapted and adopted strategies including technological, institutional, organisational and other dimensions as outlined above. The case studies consist of four city regions in Europe, Canada and Australia: Freiburg (Germany), Luxembourg City (Luxembourg), Vancouver (Canada) and Brisbane (Australia). Second, these insights are used to contribute to current scholarly debates and understandings of sustainability transitions and urban climate change mitigation policies. The main contribution relates to the international perspective that brings together insights from three continents. The four case studies provide a multisited and contextualised perspective of urban green building transitions. While some of the case studies present linear trajectories of greening and a high level of mobility of

concepts and ideas between cities, this is not the case for all of them as some are also marked by ruptures and roll back of greening initiatives. As such, the evidence presented here provides rich evidence to conceptualise trajectories from an international perspective even though they remain restricted to the Global North.

The case study research was conducted as part of a binational research project (GreenRegio or *Green building in regional strategies for sustainability: Multi-actor governance and innovative building technologies in Europe, Australia and Canada*) funded by the National Research Fund Luxembourg (FNR) and the German Research Foundation (DFG) from July 2013 to June 2016 (INTER_DFG/12-01/GreenRegio). The four case studies include the cities of Freiburg and Vancouver that have comparatively long histories of urban greening and feature recognised best practice examples and the cities of Luxembourg and Brisbane that present more recent approaches to green building. For reasons of practicability, the research presented here focused on the facets of green building related to climate change mitigation listed above. The analysis of green building transitions in the four case study city regions features micro case studies of (1) innovative green building policies and regulations, (2) leading institutional actors and new institutional and organisational arrangements (e.g. research and resource centres) and (3) the built environment represented by individual buildings (both residential and commercial) as well as neighbourhood developments including technological, socio-political (e.g. flagship buildings, social housing) and temporal dimensions. Though equally important, aspects of user well-being, health issues related to building materials as well as other social aspects (e.g. exclusive/inclusive forces of real estate market dynamics) were not explored with the same rigour. Nonetheless, these issues were taken into account where case study research suggested their strong influence on other dimensions of green building developments.

1.5 The Structure of This Book

The structure of this book is organised in three sections. The first section lays out the conceptual framework as well as the research design of the study. Part II presents the empirical results from Freiburg, Vancouver, Brisbane and Luxembourg. Part III is dedicated to the interpretation and discussion of findings bringing together the insights from the four city regions.

Part I first discusses the state of the art of scholarly debates around the notions of sustainability transitions (Chap. 2) and urban spaces as arenas for climate change mitigation (Chap. 3). An adoption of the transition studies approach to socio-technical innovations is discussed as a promising perspective for tackling ongoing changes in the building sector, including technological, organisational, institutional and social innovations. Debates about the role of cities in low-carbon policies help to conceptualise urban actors and institutional contexts. Both chapters thus try to distil the usefulness of the respective approach to green building and to derive detailed research questions for further investigation. Chapter 4 introduces the

research design and discusses opportunities and methodological challenges encountered.

Part II consists of four case study chapters each following a similar format. After a short introduction into the particularities of the respective region, the observed pathways to green building and ongoing transitions are reconstructed based on the findings obtained in the various micro case studies. Chapters 5 and 6 present the case studies of Freiburg and Vancouver which have both gained international recognition for their green building initiatives. Although their pathways have been quite different and their extant priorities vary in many regards, they currently are both positioning themselves as green cities at the global scale. Chapters 7 and 8 show the particularities of Brisbane and Luxembourg as rapidly growing city regions where more recently launched green building initiatives are driven primarily by economic imperatives. All four case study presentations discuss the main triggers for and barriers to successful green building endeavours.

Part III builds on the results presented for the four case studies and discusses the major findings regarding possible generalisations and theoretical impacts. Chapter 9 comes back to framings influenced by transition studies approaches and compares pathways and trajectories in the four cities focusing on local and regional framework conditions. More specifically, it discusses in how far and in what ways Freiburg, Vancouver, Brisbane and Luxembourg can be understood as seedbeds or niches that allow (or inhibit) green building innovations to be developed or adopted. Linking back to the discussed weaknesses of the transition studies literature on spatial dimensions of sustainability transitions, the discussion argues for a stronger relational perspective. Chapter 10 critically analyses aspects of green leadership, knowledge transfer and learning within and beyond city regions including critical reflections on environmental, economic and social implications of green building initiatives based on the four case studies. It hence responds to questions of comparability and transferability and argues for an open engagement with green initiatives that takes into account spatial and temporal relationality.

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Chapter 2
Green Building as Urban Sustainability Transitions

Abstract Over the past decade, the term *transitions* has been adopted widely in policy and academic circles, and notions of green transitions, sustainability transitions and low-carbon transitions now frequently replace the common *Leitbild* of sustainable development in local, regional and national visions and analyses. Transition studies present one particular approach to analysing and understanding fundamental changes in societies. While transition studies originally comprised historic and technocentric innovation studies that considered sociocultural dimensions as enabling context for change, the multi-level framework developed in transition studies has been recently adopted and adapted by economic and urban geographers resulting in a focus on urban transitions. The multi-level perspective in particular provides a compelling heuristic for the assessment of sustainability transitions. This chapter introduces work in transition studies and discusses the strengths and limitations of the multi-level perspective in analysing shifts in green building as urban climate change mitigation strategy. It develops a transition perspective for the green building sector that focuses on the urban in these transition processes.

2.1 Introduction

Over the last decade, debates around climate change have changed as the notion of sustainable development has increasingly been replaced by the idea of sustainability transitions or its variations including *green*, *energy* and *low-carbon* transitions. Even though the term *development* in sustainable development implies a process character of this objective, the semantic shift towards transition more strongly underlines the directed process towards a better or more sustainable state. The notion of transition also indicates a change in direction, a shift from one state to another whether set as normative goal or actual process (historical and contemporary). From a transition perspective, this change is considered to be fundamental or radical rather than incremental including a digression from the status quo which is not inherent in the notion

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of sustainable development. Be it for its novelty, for its normative if not programmatic connotation or for its presumable notion of comprehensive change, it has become a real buzzword over the past few years, increasingly marking political, scientific and media discourses on sustainable development.

The notion of transition has particularly marked debates around low-carbon policies in cities including green building strategies as one particular subset of these greening efforts. One of the aims of this book is to illustrate the various facets of transition processes in the building sector by looking at different political, regulatory and sociocultural contexts. This broad empirical scope allows for a critical revision of transition concepts prevailing in the literature. The following subchapter (Sect. 2.2) introduces the diverse transition terminology in use. For the purpose of this book, two of the concepts presented will be discussed in more detail: transition studies and urban transitions. Based on a presentation of the core characteristics of transition studies (Sect. 2.3), Sect. 2.4 provides a critical assessment of current debates and limitations of the approach. Finally, Sect. 2.5 discusses the value and suitability of the transition studies approach in respect to sustainability endeavours in urban contexts. The discussion contributes to the growing literature on the spatialities of transitions or, more conceptually speaking, on the role of geographical contexts and spatial relations to further the current understanding of the drivers of and barriers to urban sustainability transitions.

2.2 Multiple Understandings of Sustainability Transitions

The transition approach shares the destiny of other emerging terms and concepts: the multiplicity of interpretations and uses that results in terminological confusion and lack of clarity of what sustainability transitions actually are. The term transition is currently used in various fields and contexts so that an all-encompassing definition seems impossible. Box 2.1 provides an overview of different, co-existing definitions, interpretations and applications of the term transition in the realm of sustainability research. The list does not seek to be exhaustive but provides the most relevant concepts of sustainability transitions and as they relate to green building.

2.3 Transition Studies and Sustainability Research

Sustainability transition research analyses how societies can achieve a more sustainable future. The core assumption of the transition studies approach is that technological innovations are crucial to deliver change but that they always result from the interplay between social and technological processes. Initially conceived by engineers recognising the role of social sciences for the understanding of innovation processes, the concept is increasingly taken up by human geographers in innovation research in general, and more and more frequently with a focus on sustainability issues, for example, related to manufacturing, urban development, energy production or mobility and transport systems. Today, some literatures almost equal transitions with green transitions (see the debate about urban low-carbon transitions in Chap. 3).

Box 2.1 Transitions: Multiple Understandings and Common Ideas

Transition Studies

One important strand of literature at the green innovation and sustainable spatial development nexus can be found in the social studies of technologies (SST), also known as transition studies (overviews in Truffer and Coenen 2012; Elzen et al. 2004; Hansen and Coenen 2015). Compared with the more traditional work on green innovations, of which one central question relates to identifying technologies that have the greatest potential for assisting (green) transitions, transition studies widens the focus towards the interplay or co-evolution of societal and technological changes. The approach increasingly resonates with economic and urban geographers interested in local and regional sustainability transitions (Lawhon and Murphy 2012; Hansen and Coenen 2015; Hodson and Marvin 2012; Murphy 2015). Their work will be discussed in further detail below (see Sect. 2.3).

Transition Management

Following the logic of the SST approach, a more normative and planning-oriented group of scholars develops and monitors strategic niche management (SNM) schemes. These strategies aim at creating and nurturing protective spaces for niche development and innovation (Schot and Geels 2008). The term management emphasises the operational aspects of the approach. The local or regional level plays a crucial role in the way its political, administrative, economic and civil society actors co-determine the framework conditions for niche developments and possible regime changes (Schepelmann et al. 2016). For a critical assessment of the (post-)political dimension of transition management practices that questions how environmental objectives and strategies are constructed and implemented, see Kenis et al. (2016).

Low-Carbon Transitions

The notion of low-carbon transitions is prominently used as a programmatic label for recent policy strategies presenting largely normative initiatives in response to global climate change (e.g. the United Kingdom's (UK) Low-Carbon Transition Plan from 2009). Furthermore, the term energy transition has become widely used as a synonym for the German *Energiewende*, often literally translated as *energy turnaround*. Besides national policies, numerous municipalities and regional entities have committed themselves to low-carbon targets, for example, in the framework of the Climate Alliance network in Europe.

Transition Towns

Organised since 2006 under the banner of the Transition Towns Network, a growing number of communities and cities around the world see "the end of growth" as inevitable (Bailey et al. 2010) and ambitiously try to mediate low-carbon transitions at the local level (Hodson and Marvin 2012). Initiatives are usually characterised as small-scale, community-focused and bottom-up processes. Today, the transition network comprises numerous towns and cities,

but also neighbourhoods, single-community projects, enterprises, universities, schools or livelihoods, fulfilling the minimum criteria defined by the association (Transition Network 2017).

Urban Transitions

In contrast but related to the preceding notion of transition towns, urban studies scholars interested in climate change mitigation and local sustainability strategies identify cities as "critical arenas for addressing climate change" (Bulkeley et al. 2011: 3) and speak of low-carbon transitions at the local level, for example, when analysing relevant actors, institutional framework conditions and urban development and resource management policies (see more in Chap. 3).

Transition Regions

The idea of transition regions was introduced by Philip Cooke as a conceptual notion linked to successful regional development models. In his work on regional innovation processes and competitiveness, he focuses on the role of eco-innovations for regional competitiveness, that is, innovations that are not restricted to mere technical advances, but that comprise products, technologies and processes that help reduce environmental impacts. Based on internationally comparative case studies, Cooke defines transition regions as "sub-national territories, usually with some degree of devolved governance in the fields of innovation, economic development and energy that […] act as regional 'lighthouses' for eco-innovation both to other regions and countries. These are the places that are subject to 'learning visits' by global policy-makers and other interested parties eager to learn how success was achieved" (Cooke 2011: 106; see also Gibbs and O'Neill 2014). Besides this analytical and conceptual understanding, the term can also be found in the more normative and activist debates on transition towns and initiatives (see above) where it describes initiatives above the neighbourhood, village or city level (e.g. the Bangor/Brewer Region in Penobscot County of Maine) or an umbrella association of several transition towns (e.g. the Transition-Region Ammersee in Bavaria).

Within the broader school of transition studies, the multi-level perspective (MLP) is one concept that has in particular resonated with scholars in geography and social sciences. Probably due to its compelling heuristic, the MLP developed by Frank Geels and colleagues (Geels 2002) has been adopted widely and has led to a proliferating number of empirical contributions (overview in Hansen and Coenen 2015). The MLP provides an analytical framework to understand and explain socio-technical transitions using both a temporal dimension and an institutional perspective with the latter focusing on the interplay between actor groups that leads to changing norms and conventions (Fuenfschilling and Truffer 2014). The MLP distinguishes between three mutually dependent levels: landscape, regime and niche.

The *landscape* captures the overarching (exogenous) socio-technical context that sets the regulatory, political, cultural (norms and values) and environmental conditions for a particular sector or activity.

The *regime* level acts as meso-level of socio-technical systems and describes predominant organisational standards and norms, for example, prevailing rules and conventions of an established industry.

Niches act as test beds for (radical) innovations and new socio-technical constellations. They usually consist of spaces that are protected from rules and structures at the higher scales of the regime and landscape (e.g. exemptions from certain regulations or free market forces).

Successful niche innovations can evoke changes at the regime and landscape level, but change can also be triggered by changes at the landscape level. For example, environmental disasters can lead to an increased environmental awareness of the general public resulting in fundamental shifts of global climate or energy policies.

As such, transitions do not only result from path-breaking innovations at the niche level but are at least influenced by changes of the general socio-technical environment, opening windows of opportunities via regulation, research policies, tax systems, etc. This mutual articulation goes beyond the usual bottom-up and top-down logics. Rather, it has to be understood as a continuous interplay of various actors at all levels marked by power relations and vested interests on all sides. Illustrations for this can be found, for example, in Jesse Hoffman and Anne Loeber's study on the micropolitics of greenhouse innovations in the Netherlands in which they develop what they call "a relational perspective on power in transitional change" (Hoffman and Loeber 2015: 693).

Figure 2.1 relates the MLP framework to the building sector and its potential greening. Here, the landscape and highest level of the perspective comprises international and national policies of energy and climate change mitigation which provide the contextual framework (Moore et al. 2014) of the building sector. The recent EU energy policy, for example, immediately impacts building standards and practices.

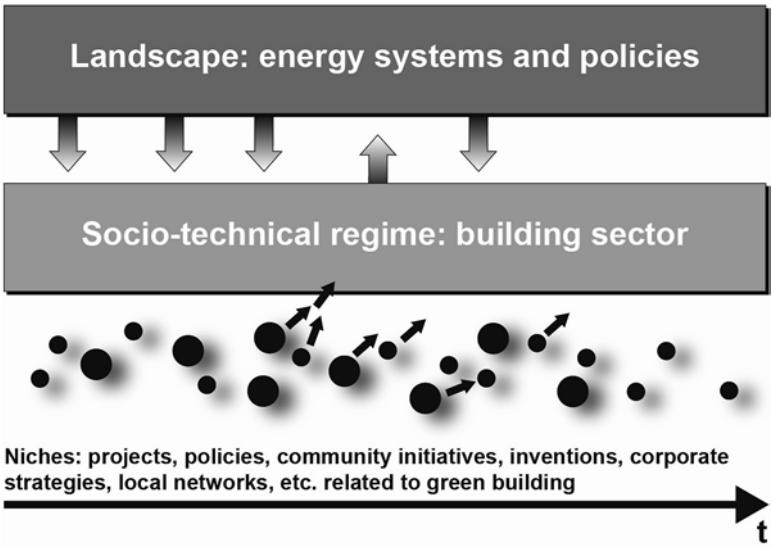

Fig. 2.1 The multi-level perspective adapted to the building sector (Illustration: Ulrike Schwedler, based on Schulz and Preller 2016: 274)

As discussed later in Chap. 9 in more detail, the landscape level by no means is limited to superior administrative or political levels. The cases of Freiburg and Vancouver, for example, show that local policies and regulations are a pertinent part of the landscape thus creating a particular local context. The latter may also include specific attitudes and value systems (e.g. in the case of Vancouver, this is captured in the notion of the West Coast spirit characterised by strong environmental consciousness amongst the public) which are the outcomes of more general societal transformations (e.g. changes in policy objectives, lifestyles and consumption patterns). In cases where sustainability goals are shared by many stakeholders and decision-makers, like in Freiburg's collective efforts to set vanguard energy standards, the context conditions are more likely to have a transformative impact on the regime level. There, the predominant or established building sector usually tends to perpetuate existing routines, norms and other institutions.

Again, the regime *level* is not to be understood as another spatial *scale*, for example, in the sense of a regional milieu of building practices being the localised articulation of framework conditions set at a superior scale (national/international). Rather, the notion of level helps to analytically distinguish particularities of a single sector or field of activities (regime) from the more general context (landscape). Obviously, the relationships and interactions between the levels are reciprocal and in no way hierarchical (top-down or bottom-up); they constitute the co-evolutionary dimension put forward in institutionalist and evolutionary approaches in economic geography and further operationalised in transition studies.

The niche level may encompass all sorts of heterodox, experimental and pioneering endeavours in the building sector, practised in a particular context and relying on individual actors' decisions and agency (co-)produced in specific actor networks, potentially determining innovations and further development trajectories. But actor constellations are far from limited to local arenas and can connect places and people over longer distances (see policy mobility in Chap. 3).

2.4 Limitations of the Transition Studies Approach and Current Debates

Most empirical studies on socio-technical transition follow a sectoral approach by looking at one particular industry or technology, usually in a given national context (see Geels (2002) on the steamship industry in the Netherlands or Schot et al. (1994) on car manufacturing). While the aforementioned examples were primarily led by an interest in technological innovation and new market configuration, sustainability aspects have gained traction over the last years. Verbong and Geels (2010), for example, look at the role of the electricity sector's infrastructure in energy transitions, while innovation trajectories in the photovoltaics (PV) industry are analysed by Dewald and Fromhold-Eisebith (2015). Geels et al. (2017) focus explicitly on decarbonisation approaches, and Zademach and Dichtl (2016) are probably the first applying the MLP to the greening of the financial sector in relation to energy transitions.

Avelino and Wittmayer (2015) provide a cross-sectoral view that brings together an explicit interest in sustainability transitions and a differentiated understanding of actors and their agency. In their multi-actor perspective (MaP), they seek to overcome too rigid distinctions made between both levels (see MLP) and actor groups. They draw on so-called third sector organisations which are not-for-profit civil society actors that neither belong to the public nor to the commercial sector (Evers 2008; Pestoff 2014) with the potential to form hybrid organisations around unusual actor constellations (Schulz and Preller 2016).

Through its institutional perspective, the MLP thus can help to focus on relevant actor groups, framework conditions (political programmes, research policies, funding and tax systems, consumption practices, cultural meanings, etc.) and temporal dimensions that "can be used to shift the gaze of human geographers from particular artefacts or static socio-material patterns towards the co-evolution of technology and society, and the dynamic interactions between multiple social, political, and economic scales" (Lawhon and Murphy 2012: 355). As such, it offers a heuristic analytical framework to unravel the complex nature of sustainability transitions.

While the mutual ties between the social and the technical dimensions of innovation processes (i.e. the necessity for a co-evolutionary perspective) are widely recognised, the rather rigid, hierarchical logic of the multi-level transition framework has been increasingly criticised. Geographers have been most critical about the lack of spatial sensitivity (Coenen et al. 2012; Hodson and Marvin 2012; Raven et al. 2012; Truffer and Coenen 2012; Schwanen 2017) and the neglect of the socio-political nature of urban sustainability transitions (Lawhon and Murphy 2012; Meadowcroft 2011; Smith et al. 2005; Shove and Walker 2007). The latter encompasses the power relationships between actors, which need to be addressed in order to grasp the diversity of sustainability experiments and inventions including failed and successful and changing and stabilising ones. This requires a sensitivity for the respective spatial context (e.g. specific governance patterns), as Raven et al. (2016) demonstrate in their analysis of six low-carbon technology case studies in the United Kingdom and the Netherlands.

One major limitation of the MLP lies in the common (but maybe intuitive) equalisation of multiple levels with hierarchical spatial scales where socio-technical regimes and niches are conceptualised as separate entities that are being conflated with the national and local scale (Bulkeley et al. 2014). In a cross-fertilising way, spatial concepts can help address limitations of socio-technical transition theory by opening up the clear-cut multi-level perspective to a relational thinking that blurs the boundaries between niches and regimes. For example, the multi-level perspective has mainly been employed to describe historical developments of how successful innovations spread but neglects to explain ongoing developments as well as where, how and through which actor constellation innovations come into being. Nevertheless, sensitive applications of the MLP perspective complemented with a relational spatial understanding provide a helpful heuristic to empirically address ongoing

> transitions [that] are shaped both by the ways in which socio-technical systems are embedded in particular territorial contexts, and by the multi-scalar relationships linking their heterogeneous elements to actors, materials, and forces situated or emanating from different locations or scales. (Murphy 2015: 75)

As argued by Binz et al. (2014), a relational perspective is needed to conquer the use of national *containers* as contextual frameworks for localised transitions. It allows to direct inquiry towards the actual spatial and temporal articulations of the respective actor networks, learning processes and knowledge diffusion. Relational thinking further helps to avoid the frequent reification of spatial scales or political levels preventing an overrating of particular structural elements. Shove and Walker (2010) postulate a more horizontal view of co-existing developments or practices to avoid hierarchical perspectives and allow overcoming structure and agency dichotomies.

The project presented in this book aims to overcome the structural rigidness often associated with the MLP by dissolving the idea of clearly bounded levels and, simultaneously, seeks to avoid "the trap of reducing and flattening these governance arrangements to the level of the city" (Hodson et al. 2017: 2). Furthermore, the approach taken here abstains from defining clear borders of the case study cities or city regions. Rather, they are understood as being the places where different scales as well as different influences from different places interact. Cities are conceived as nodes in a network of relations between and flows of policy ideas, tools and concepts that are partly travelling between remote places and co-shaping landscapes, regimes and niches in a given setting. These relational aspects will be discussed in more detail and further conceptualised in Chap. 3.

Another criticism of technocratic transition research lies in its focus on "narrow social interests" and elite actors as technical experts and entrepreneurs (Hodson and Marvin 2011; Lawhon and Murphy 2012) that ignores political contestations, inequalities in power relationships and access to transition decisions as well as failed experiments. There is hence a risk in the urban sustainability transition literature to ignore "the multiple facets of 'the urban'" that "are both constructed on and imply quite different financial, socio-spatial, metabolic and governance configurations" (Coutard and Rutherford 2011: 122). In their case study on off-grid energy production in Stockholm's emblematic Hammarby Sjöstad, Coutard and Rutherford (2011) show that there can be divergent imaginations of and strategies towards low-carbon transitions, rivalling simultaneously in the same urban context. What is celebrated as success by some can be contested by others. For example, local electricity production through PV panels is promoted by some as green energy solution, while they are criticised by others as relatively expensive infrastructure that not all dwellers can afford.

Several human geographers have brought spatial dimensions into transition studies through a number of conceptual proposals. For example, Coenen and Truffer (2012) as well as Raven et al. (2012) aim at making MLP compatible with contemporary thinking in regional development and innovation research. Similarly, Bulkeley et al. (2014) and Lawhon and Murphy (2012) refer to political ecology to introduce a spatially informed understanding of agency and power relationships in

a transition context. Gibbs and O'Neill (2014), however, argue that these proposals remain at a high level of abstraction themselves and provide only limited empirical illustrations and evidence. There are a few exceptions though including, for example, Anna Davies' work (2013) on clean-tech clusters as well as Bridge et al. (2013) on energy transitions.

2.5 Transitioning Towards Green Cities

One particular strand of sustainability transitions research has identified the urban arena as a critical area for the study of low-carbon transitions due to the impact that cities have and are likely to experience in the future regarding climate change mitigation. Recent contributions to urban sustainability transitions contain more specific illustrations of how cities can be integrated into transition studies (Rohracher and Späth 2014; Späth and Rohracher 2015; Roberts et al. 2014; Hodson et al. 2017). Following the assumption prevalent in strategic niche management that

> sustainable innovation journeys can be facilitated by modulating of technological niches, i.e. protected spaces that allow nurturing and experimentation with the co-evolution of technology, user practices, and regulatory structures (Schot and Geels 2008: 538)

The local and urban scale are seen as central to the ways political, administrative, economic and civil society actors co-determine the framework conditions for niche developments and regime changes. For example, contributions have highlighted the role of cities as sites of niche experiments (Coenen et al. 2010; Healy and Morgan 2012; McCauley and Stephens 2012), living laboratories (Evans 2011; König 2013) and "sites of feasibility demonstrations" (Rohracher and Späth 2014: 1427). This includes not only the support of concrete projects and pioneering initiatives or the proactive shielding of recognised niches (e.g. through specific building codes and tax incentives) by local governments and other stakeholders. It also encompasses the specific local context conditions or sociocultural characteristics that may make certain places more fertile for sustainability transitions. This includes the existence of what Longhurst (2015) calls *alternative milieus*. Alternative milieus are characterised by a high density of alternative institutions and structures which are linked to environmental, social or cultural values and norms that challenge the status quo and existing institutions. Rather, they promote alternative forms of development and can provide a niche for experimentation. One expression of alternative milieus are the transition towns (Longhurst 2013), but these milieus may also be found within larger cities. For example, Longhurst links alternative milieus to the counterculture movement in the 1960s which emerged out of large cities such as New York City, San Francisco and London. Similarly today, different cities can be associated with different political orientations that may promote or inhibit sustainability transitions.

As highlighted by the relational understanding of cities (Sect. 2.4), niches are not autonomous or shielded spaces but rather shaped through spatial processes of exchange and learning. Numerous transnational and environmental associations

including Local Governments for Sustainability (ICLEI) with its Cities for Climate Change Protection (CCP) programme, the Climate Alliance, the Energy Cities and the C40 Cities Climate Leadership Group attest to the prevalence of local and case-specific strategies in climate change mitigation initiatives that connect local and municipal actors around the globe (see also Healy and Morgan 2012).

An adaptation of transition studies (and the MLP in particular) to more spatially sensitive concepts still risks reifying space and scales. Raven et al. (2012) plead for a relational understanding to grasp the complexity of institutional settings and actor constellations and to avoid an essentialist view on absolute scales (local, regional, national, etc.). Also, case study research tends to isolate local spaces from superior levels of governance and of other forms of spatial interaction (e.g. international corporate sector) and thus ignore "wider social, economic and political processes which shape sustainability in urban places" (Bulkeley and Betsill 2005: 58). In particular, urban or other local scales must not be equalised with the MLP's niche, regime and landscape levels nor with other spatial scales. Rather, niches, regimes and landscapes are simultaneously present in any place where niche activities can (or cannot) articulate with incumbent regime actors in the context of specific landscape conditions. Similarly, cities (i.e. actors based in a city or activities emerging from a city) can themselves be "shapers" (Hodson and Marvin 2010: 59) of transitions at the landscape level. In a similar vein, it is argued that there is a need to move "beyond a view of cities and regions as simply places for experimentation and demonstration [linking] together the niche with the regime and landscape" (Gibbs and O'Neill 2014: 204–205).

Transition studies scholarship has received multifaceted criticism and has been very receptive to critical voices illustrated by its effort to improve the approach and the high level of reflexivity with which protagonists of the approach react to critical comments from neighbouring disciplines. In his *self-defending* paper, Geels responds to the seven most frequent criticisms (Geels 2011). Amongst others, he relativises the initial understanding of MLP as a nested hierarchy and tries to counter-balance the *bottom-up bias* inherent to the MLP approach. This relates to the risk to overrate the role of niches in socio-technical change while underestimating the importance of or the interplay with other levels. Fuenfschilling and Truffer (2014) plead for a stronger conceptualisation of the role of institutions in MLP in order to better assess the articulation between structures and agency. Regarding the use of the MLP in urban sustainability research, Hodson et al. (2017) argue in favour of multiplicity when looking at the wide range of urban experiments (both social and technological) that co-constitute urban reconfigurations. Most recently, Geels et al. (2017) in their contribution to decarbonisation policies acknowledge the pertinent role of non-technological niche developments (e.g. forms of organisation, participation and behaviour) and their frequent co-occurrence with major changes at the landscape levels so that short policy window opportunities may help accelerate change at a given tipping point.

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Chapter 3
Urban Sustainability and the Governance of Greening

Abstract Cities have long been seen as important in achieving sustainability. However, conceptions of and approaches to urban sustainability and greening have changed over time from a primary focus of environmental problems as urban problems to cities as leaders in global climate change mitigation. This chapter provides a brief overview over the changes in understandings of and research on urban sustainability over the past few decades with a specific focus on governance and sustainability approaches. The literature review provides the context for situating and understanding green building transitions in the four case study regions where interpretations and implementations of green building have changed over time and need to be understood within the broader spatial and temporal context. The chapter introduces the concept of policy mobility and related work on urban assemblages that emphasise the relational character of local and urban processes. These perspectives understand cities as consisting of both local and global influences and elements. One emphasis of policy mobility is to understand these relationships through processes of learning, adaptation and mutation of knowledge and practises (e.g. green building policies, certification programs, planning approaches and construction techniques) between individuals and actor groups such as policy-makers, consultants, scientists, urban designers and architects. The chapter proposes an analytical framework that utilises the synergies of policy mobility and transition study approaches and that addresses the complexity of sustainability transitions as socio-spatial and socio-technical processes.

3.1 Introduction

The ideal of the sustainable or green city has become a central element of urban planning, policy-making and development strategies over the past few decades. Objectives of smart growth, sustainable cities, sustainable urbanism and green cities are shaping urban agendas and commonly contribute to core objectives in cities around the world (Joss 2010). Whether through the construction of new eco-cities or eco-districts,

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through retrofitting of the built environment and upgrading of existing infrastructure or green policies to regulate current and future impacts, cities are seen as "both harbingers of future conditions and test beds in which to establish more sustainable ways of living" and have become "subject to ever more vigorous ecological conceptualization" (Evans 2011: 223). Cities around the world are setting ambitious environmental goals, implementing socio-technical innovations and cooperating and competing as global climate change leaders (Bulkeley et al. 2011). First discussed at the international level at the United Nations Conference on the Human Environment (UNCHE) in 1972, the idea of the *sustainable city* underlines the importance to plan and manage human settlements, particularly urban areas, in a way that does not threaten local and global environmental quality. Since the 1990s, a large number of programs for sustainable urban development have been launched from the transnational (e.g. European Sustainable Cities Programme, Reference Framework for Sustainable Cities) to the local level (e.g. Local Agenda 21, smart growth) including numerous city networks. More recently, a summary report by the German Advisory Council on Global Change (WBGU 2016) in preparation of the Habitat 2016 conference emphasised the *transformative power* of cities towards sustainability goals.

Considerable research has focused on urban sustainability including work on sustainability initiatives such as green policies, regulations, infrastructure and neighbourhood developments (goals and objectives, drivers and barriers of such policies, strategies, technologies, etc.), their implementation (governance processes, sustainability in practice, challenges and opportunities) and relevance of these initiatives beyond the urban scale (e.g. transferability, best practices, good governance, policy transfer and mobility, etc.). Whitehead (2003) and Bulkeley and Betsill (2005) have criticised one strand of work which has been mainly concerned with the practical, political implementation of sustainability (e.g. Haughton and Hunter 1994) as it runs the risk to reduce the analysis to technical issues of institutional restructuring, traffic management, architectural design and the development of green technologies. Another more ontological perspective of urban sustainability "tends to give a neutral, almost apolitical, veneer to sustainable cities and conceals the asymmetries of power which inform the social construction of urban sustainability" (Whitehead 2003: 1187). Green building in cities is largely influenced by urban planning and design, decisions related to infrastructure provisioning, green policies and regulations as they relate to the local and urban scale. This emphasises the importance of urban governance, planning processes and policy research to understanding geographies of green building and underlying power relationships. While many initiatives are launched and supported at the municipal scale, the urban scale here refers to specific places or locales that have urban characteristics (e.g. density of population, social and economic activities, expressions of public culture), but that may extend beyond the political jurisdiction of urban local authorities. Further, cities are not isolated containers but relational spatial constructs influenced by different spatial scales (Massey 2005). Urban governance research has increasingly focused on the interplay of spatial scales through approaches of multi-level governance and work on policy transfer and mobility, while geographical engagements with transition studies equally have emphasised a need for spatial sensitivity (see Chap. 2).

This chapter identifies some common threads in the urban governance and sustainability literature and brings these together with ideas presented in Chap. 2 to develop a conceptual framework that allows to capture and make sense of geographies of green building in Freiburg, Vancouver, Brisbane and Luxembourg. The next section (Sect. 3.2) presents a brief overview over approaches to urban sustainability and how they developed over the past five decades in particular in respect to how they have been discussed in urban studies and related disciplines. Section 3.3 presents a more critical view of urban sustainability initiatives shifting the emphasis to narratives, framings and interpretations of sustainability highlighting the importance of governance approaches in understanding green building in urban areas. More specifically, Sect. 3.4 highlights recent work on policy mobility as a relational perspective on urban sustainability transitions that can help reveal the local and global aspects of urban greening. In this regard, it also discusses the role of the urban in respect to other scales as well as its boundaries, in particular the fuzziness and relationality of the urban scale and urban governance processes with their inherent challenges and conflicts. The last section (Sect. 3.5) brings together sustainability transition thinking and urban research perspectives to present the framework of analysis applied to the case study cities discussed in Part II of the book.

3.2 The Rise of Urban Climate Change Governance

Ideas of cities as environmentally and socially sustainable places are not new. Urban planners and designers have developed proposals to address negative impacts of large-scale urbanisation (related to industrialisation) since the nineteenth century including, for example, Howard's Garden City, Le Corbusier's Radiant City and the British New Towns. These approaches usually proposed some grand vision of green urban structure and design that, as criticised by Jacobs (1965), did not respond to real, ordinary cities nor helped address urban problems. The new sustainable urbanism that emerged in the late 1960s and early 1970s as part of the rise of the new environmentalism differed from these approaches and is frequently seen as an early wave of sustainability and greening initiatives in cities (Joss 2010; Whitehead 2003). Even though the concept of sustainability did not emerge until the mid 1980s, urban problems were seen as a combination of environmental, economic and social crises triggered by rapidly sprawling and heavily polluting urban agglomerations leading to deteriorating living conditions for many urban residents. Rather than seeking to impose new forms on urban structure, urban scholars and practitioners focused on the potential of cities for sustainable development through a "vision of a compact, mixed-use urban setting" (Whitehead 2012: 32) also associated with smart growth. The concept of the sustainable city or neighbourhood was characterised by integrated thinking largely influenced by urban planners and designers on green neighbourhoods and eco-cities with a strong focus on stakeholder engagement and bottom-up processes (Barton 1998; Beatley and Manning 1997; Beatley 2000; Roseland 1997, 2000). Freiburg's green neighbourhoods but also Vancouver's Olympic Village in Southeast False Creek incorporate many of these ideals.

Table 3.1 Timeline of main urban sustainability events, documents and declarations (own research and Whitehead 2003, 2012)

Year	Event/initiative	Urban sustainability focus
1972	United Nations Conference on the Human Environment (UNCHE), Stockholm	Introduction of the idea of the "sustainable city"
1976	Habitat I—United Nations Conference on Human Settlements, Vancouver	First document (Vancouver Declaration) to lay out principles of sustainable urbanism
1987	World Commission on Environment and Development	Chapter 9 of the Brundtland Report focuses on "The Urban Challenge"
1990	European Commission's Green Paper on the Urban Environment	Highlights the need to focus on urban environmental issues
1992	United Nations Conference on Environment and Development, Rio de Janeiro	Local Agenda 21 explicitly places sustainability on the agenda of local governments
1993	European Sustainable Cities Programme	Focused on sustainability in European urban settings
1996	Habitat II—second United Nations Conference on Human Settlements, Istanbul	Focused on the implementation of Local Agenda 21 in urban areas
2000	Millennium Development Goals	Goal #7 focused on sustainability more broadly
2002	Second United Nations Conference on Environment and Development, Johannesburg	Focus on sustainability more generally
2012	"Rio+20"—third United Nations Conference on Sustainable Development, Rio de Janeiro	Promotion of sustainable patterns of production and consumption
2015	UN Sustainable Development Goals	Sustainable cities and communities
2016	Habitat III—third United Nations Conference on Housing and Sustainable Urban Development, Quito	Focused on housing and sustainable urban development; WBGU document on the transformative power of cities

The emergence of climate change debates in the late 1980s shifted the focus of urban sustainability research from largely local concerns to a perspective of global-local dependencies (Table 3.1). A growing body of work started to focus on how cities address global problems at the local scale through urban carbon control and climate change mitigation (Betsill 2001; Bulkeley and Kern 2006; Deangelo and Harvey 1998; Jonas et al. 2011; McEvoy et al. 1999; While et al. 2010; Wilbanks and Kates 1999). Rather than questioning the ideals of sustainable cities and neighbourhoods, climate change debates provided a new context within which sustainability and its objectives and meanings were being (re)considered. Many scholars and policy-makers identified cities and the local level as the optimal scale to mitigate action on climate change due to the ecological footprints of cities and their levels of greenhouse gas emissions (UNEP 2011; Hoornweg et al. 2011), the authority municipal governments have over local land use planning and their willingness to integrate sustainable development goals (see Chap. 1 as well as Bulkeley and

Betsill 2005). Bulkeley (2013) distinguishes between an earlier phase of *municipal voluntarism* in the early 1990s during which a number of municipalities developed local climate change policies and the broad adoption and mainstreaming of climate change action as *strategic urbanism* that led to a significant increase of municipal action during the late 1990s. This development reflects the shift from earlier, primarily local planning strategies to a (re)emergence of regional development strategies that were rolled out at a broader scale.

Early voluntary initiatives by individual municipalities emerged in the 1990s and were often driven by a longstanding interest of local constituencies in sustainable development. For example, and as described in more detail in Chap. 5, interest in green building in the city of Freiburg developed out of a broad public opposition to nuclear power and a strong interest in identifying alternative, green energy sources including solar energy for buildings. Similarly, Vancouver's image as a green city is frequently embedded in a history of early environmental activism but also linked to its natural setting (see Chap. 6). While individual cities set their own targets and declared their goals to reduce greenhouse gas emissions and developed climate change policies and other strategies, municipalities also started to develop partnerships with each other to connect and share their experiences but also to mobilise at a global scale. A number of city networks were founded during this time including Local Governments for Sustainability (1990) originally known as International Council for Local Environmental Initiatives (ICLEI), the Climate Alliance (1990) and Energie Cités (1994).

The late 1990s saw a second wave of municipal initiatives characterised by the expansion of existing and the creation of new municipal networks. This phase of strategic urbanism saw climate change become an integral part of wider urban agendas with a strong emphasis on the management of carbon emissions (Bulkeley 2013). For example, the relatively recent European Covenant of Mayors was launched by the European Commission in 2008 where signatories commit to strict greenhouse gas reduction targets through increased energy efficiency and transition to renewable energy. In April 2016, the Covenant of Mayors counted more than 6600 signatories. But the surge was not only in response to renewed national and international commitments to address climate change (driven by increased scientific evidence of the scale and severity of the problem); it also illustrates municipal frustration with limited action and contradictions of initiatives at the national and international scale. The C40 Cities Climate Leadership Group network consists of 40 of the world's largest cities and further affiliate members and illustrates the willingness of these cities not only to claim responsibility but also to take leadership in climate change action. With the emergence and growth of these initiatives, urban sustainability and greening was no longer defined by actors in the Global North but was increasingly adopted by cities in the Global South (Bulkeley 2013).

This roll out of urban climate change policies and sustainability initiatives has been accompanied by a change in the way greening is being understood and implemented. The shift towards a focus on carbon emissions has resulted in increased efforts to quantify the amount of carbon that is being released or reduced within certain areas (usually at the urban or municipal scale). This shift towards carbon

accounting initiatives is also evident in the four case study regions although to varying degrees. Commitments such as the Covenant of Mayors rely on setting of targets to reduce carbon emissions that are usually sought to be achieved using a number of variables or proxies to measure the success of climate change strategies. Urban policies including Vancouver's Greenest City 2020 Action Plan provide another example of such an approach. Green building certification schemes adopt the same logic of quantifying building characteristics and performances to allow transferability, comparison and evaluation of their success. Across the four case studies discussed in Part II, interview respondents highlighted the centrality of quantified approaches to promoting and establishing green building (for a discussion of limitations, see Sect. 3.3).

Green and clean technologies are also playing a major role in this shift in urban sustainability thinking. They do not only provide solutions to reduce the use of fossil fuels and other sources of carbon emissions, but they also address aspects of economic development through the promotion of a green economy and linked to it (regional) economic sustainability. A significant amount of work has highlighted the role of technology and focused on a number of key sectors including transportation, energy, waste and building (McCauley and Stephens 2012; Raven and Geels 2010; Verbong and Geels 2010). An infrastructural perspective supports the idea that "urban low-carbon transitions are mediated by the urban infrastructure and the socio-technical regimes in which they are immersed" (Haarstad 2016: 6). This perspective is closely tied to work in transition studies that more recently has been utilised by urban geographers (Bulkeley et al. 2011; Rutherford and Coutard 2014) (see Chap. 2). The strong reliance on technology is particularly evident in concepts of smart cities that promote technologically advanced, socially inclusive and green cities. Smart technologies are seen as the key to increase efficiencies including energy and water but also other infrastructure and social services within cities with the ultimate goal to cut costs. These approaches have been criticised as relying on technological fixes and "hyper-technological rationalities and new geometries of power" in favour of those controlling technology and data (Vanolo 2014: 883). A focus on green, clean and to a lesser extent smart technologies is also evident in green building transitions in the case studies presented (see Part II). In Luxembourg and Vancouver, for example, the promotion of green building and green technologies is clearly present in political rhetoric and development strategies and strongly linked to rationales of economic prosperity which are often associated with enhanced quality of life. Criticism is growing related to the social costs of these technocratic approaches that appear to reinforce existing inequalities, power relationships and growth-dominated thinking.

3.3 Assessing Urban Greening

The changed context and understanding of sustainability and greening from local problems to global challenges of climate change outlined above illustrate the multi-scalar dimension of urban sustainability. While there is general agreement in the literature that cities and urban agglomerations are strongly influenced by processes

at different spatial scales transcending the local, approaches to analyse urban sustainability vary considerably. In the geographic literature, strong emphasis is placed on the local context, for example, with respect to urban planning, the policy context and the perspectives and understandings of actors involved, providing a very-context-specific, localised process of putting policies and strategies into practice (Lombardi et al. 2011) as well as work on community or local empowerment, citizen participation and sustainable communities (Barton 1998; Roseland 2000). At the same time, "cities are widely seen as governed through processes above and beyond the territorial boundaries of cities themselves" (Haarstad 2016: 4). Further, there is a strong trend—and this is not restricted to recent work—of *debordering* local policies and practices, on transferable models, best practices and success stories from elsewhere that are circulated internationally and globally (Peck and Theodore 2015).

Campbell (1996: 301) argued in the 1990s with respect to the planning community that "In the battle of big public ideas, sustainability has won: the task of the coming years is simply to work out the details, and to narrow the gap between its theory and practice". This task has clearly not been an easy one, and many have argued that the elasticity of the concept that has been used to interpret and redefine the concept and the challenges to realise a triple win in practice bears their risks (Lombardi et al. 2011; Eden 2000). Considerable criticism has emerged in response to the surge of urban sustainability campaigns both in terms of processes and outcomes. For example, While et al. (2004), Lombardi et al. (2011) and Long (2016) amongst others highlight how urban greening strategies have been hollowed out and twisted to cover a range of bases. Governance approaches are common tools in the analysis and the effectiveness of urban sustainability approaches as they help to grasp different actors and processes. Whereas more traditional governance approaches have focused primarily on aspects of stakeholder engagement, representation and participatory tools, more recent research has paid attention to the role of underlying power structures, the strategic use of greening and sustainability narratives.

One strand of the literature has focused on identifying successes and limitations of sustainability strategies both with the aim to explain unique developments but also more normatively to identify common denominators. This strand of urban sustainability research has addressed the challenges of defining and categorising urban greening initiatives. The 12th Science for Environment Policy Report by the European Commission (2015) provides an overview over "the best currently available indicator tools for sustainable cities, focusing on the environmental dimension". It identifies a number of transferable or scalable and easy-to-use approaches illustrating the high interest in indicator tools by urban authorities (Table 3.2). This illustrates trends towards quantifiable approaches, metrics, accountability, reporting and comparison in greening initiatives. While measurable targets allow tracking of progress and hence present very effective and powerful approaches in climate change mitigation, critics have raised concerns that this may shift campaigns towards using measurable and achievable targets that will prioritise achieving these targets over other actions. Even where targets may be of high relevance, variables and proxies used to measure progress may not generate the highest impact but include ones that are easier to quantify, measure and achieve. Further, and with

Table 3.2 Examples of "easy-to-use sustainable city indicators" as identified in the Science for Environment Policy report (European Commission 2015)

Indicator/toolkit	Organisation	Further information
China Urban Sustainability Index	Urban China Initiative	http://www.urbanchinainitiative.org/en/resources/report.html
City Blueprint	Waternet Amsterdam; KWR Water Cycle Research Institute	http://www.watershare.eu/tool/city-blueprint/start/
European Green Capital Award	European Commission	http://ec.europa.eu/environment/europeangreencapital/press-communications/egca-publications/
European Green City Index	Economist Intelligence Unit; Siemens	https://www.siemens.com/press/pool/de/events/corporate/2009-12-Cop15/European_Green_City_Index.pdf
Indicators for Sustainability	Sustainable Cities International	http://sustainablecities.net/wp-content/uploads/2015/10/indicators-for-sustainability-intl-case-studies-final.pdf
Reference Framework for Sustainable Cities (RFSC)	RFSC	http://www.rfsc.eu/
STAR Community Rating System	Sustainability Tools for Assessing and Rating Communities (STAR)	http://www.starcommunities.org/
Cities Statistics (Urban Audit)	Eurostat	http://ec.europa.eu/eurostat/web/cities
Urban Ecosystem Europe	International Council for Local Environmental Initiatives (ICLEI); Ambiente Italia	http://informed-cities.iclei-europe.org/fileadmin/template/projects/primus/files/ECOURB-UE07-FINALREPORT-EN6.pdf
Urban Metabolism Framework	European Environmental Agency	http://ideas.climatecon.tu-berlin.de/documents/wpaper/CLIMATECON-2011-01.pdf
Urban Sustainability Indicators	European Foundation for the Improvement of Living and Working Conditions	https://www.eurofound.europa.eu/sites/default/files/ef_files/pubdocs/1998/07/en/1/ef9807en.pdf

respect to cities, actors need to rely on variables and targets that can be linked to the urban scale which may be difficult to define (While et al. 2010). Infrastructure provisioning, for example, often transcends municipal boundaries as services (e.g. waste, water, energy, transportation) are provided for the larger region rather than within municipal boundaries alone. This makes it difficult for municipalities to include transboundary systems into their climate change account.

Another focus in the literature revolves around the identification of drivers and barriers of greening and linked to that, frequently the search for replicable and transferable success models or best practices. Questions of the transferability and comparability of urban sustainability initiatives and approaches are not straightforward as they are spatially complex: what works in one place may not be right in another. Work by Joss (2010) and Holden et al. (2015), for example, have focused on identifying and categorising urban sustainability developments that are frequently considered to be "aspirational and world-class model sustainable community developments" (Holden et al. 2015: 11419). Similarly, van Doren et al. (2016) identify different ways through which low-carbon urban initiatives can be scaled up in order to increase impact. Bulkeley (2013) distinguishes between (1) institutional factors including a range of resources such as know-how and expertise, financial resources but also the ways in which responsibilities of climate action are allocated and negotiated between different institutions; (2) political factors highlighting the centrality of individual political leaders, policy entrepreneurs or thought leaders; and (3) socio-technical factors focused on material and technical systems. Interest in these latter factors has brought together work in transition studies (see Chap. 2) and urban governance to investigate *urban sustainability transitions* taking a stronger technological focus and solution-oriented approach (Bulkeley et al. 2011; Rutherford and Coutard 2014). But it is the intricate relationships between these factors that require further scrutiny, many argue. In this regard, Fitzgerald and Lenhart (2016) have highlighted the lack of longitudinal studies and the importance of post-occupancy studies that focus on the success of green building in practice as they are being used and inhabited. They argue that publicity and success stories of eco-districts are not necessarily supported by actual outcomes and that more needs to be done to evaluate the long-term sustainability of urban greening initiatives (on Stockholm see also Rutherford 2008).

Despite the rich literature on environmental governance within geography and related disciplines, the majority of work is focused on environmental policies and mainly adopts normative approaches including good governance studies and best practices as mentioned above. Critics of these approaches have highlighted uneven power relationships and the role of actors, networks and eventualities through which information and experiences travel. Empirical evidence of traded and transferred policies and planning processes, often interpreted as best practices, reveals a persistent neglect of environmental and social aspects in favour of economic interests (Krueger and Gibbs 2007; McCann and Ward 2011; Cook and Swyngedouw 2012; Temenos and McCann 2012). This neglect is similarly reflected in governance analysis that fails to overcome the predominant *nature-culture dualism* (Parra and Moulaert 2016) and fails to provide a balanced account of environmental, sociocultural and economic dimensions that underlie the political contestation of land use policies and practices.

While governance inherently assumes the inclusion of a broad range of actors including the public or community, vested interests tend to dominate decision-making processes (Hodson et al. 2016). Bulkeley (2013) highlights the central role of municipal governments through strategies of self-governing, provisioning and regulation but rightly highlights the need to critically examine drivers and motivations behind municipal greening. Krueger and Gibbs (2007) and Temenos and McCann (2013) have raised questions on social inequalities, exclusions of urban sustainability of these strategies (regulation and provisioning) and the extent to which different actors are able to access and influence these processes. Urban sustainability is frequently shaped through specific discourses and narratives that help legitimise certain strategies and practices and that may deviate from sustainability objectives (Freytag et al. 2014). For example, climate change action, sustainability and greening have been used as powerful tools not only to tackle urban climate change challenges such as pollution, traffic congestions and energy consumption but also to promote or brand cities to boost their image (McCann 2013) as particularly evident in the cases of Vancouver and Freiburg but also Luxembourg (see Chaps. 5, 6 and 8).

Cook and Swyngedouw (2012) as well as Kenis and Lievens (2015) attest a general trend in (Western) societies to accept sustainability as good and to conflate greening with a triple bottom line. Similarly, Wilson (2015: 2) emphasises the "politically unstable, tenuous, and ever blinkering character of this dominant sustainability vision" that is promoted around the world and considers sustainability as value-free and impartial development and planning ideal that can deliver a triple win. He highlights the "elaborate discursive" elements that are often tightly linked to technical knowledge and solutions (Wilson 2015: 2). Most of these critical contributions are indeed cautious of technological solutions as proposed by ecological modernisation that suggests environmental benefits through economic development and growth.

3.4 Urban Greening and Policy Mobility

Innovations (in green building) are driven by processes of learning and knowledge exchange that are closely linked to individual choice. The relatively recent policy mobility approach focuses on how cities learn about urban policy innovations and how (good) practices circulate from one place to another employing an actor-centred perspective (McCann and Ward 2010, 2011). In contrast to earlier work on policy transfer that has been primarily concerned with what policies and innovations were transferred, a policy mobility perspective highlights aspects of mobility, transfer, adaptation and translation of policies from one location to another (see, e.g. Stone 2012). The perspective is not driven by normative ideas of replicability and scaling up of best practices but by an interest of how, when and why urban policies, knowledge and practices travel and change in the process. In particular, it highlights that policies are never just transferred but are always adapted and transformed when

implemented elsewhere. It embodies a response to two critiques of (environmental) governance analysis within geography and related disciplines. First, work on environmental governance frequently adopted by policy-makers tends to emphasise economic viability and growth over social and environmental values in local and regional development as evident in the case of green building transitions in Luxembourg. Secondly, there is a strong focus on normative approaches regarding the management and uses of space, resources and rights which often overlook many of the core constituents of real, on the ground processes. Policy mobility rejects the idea of localised best practices and models of good governance and highlights context-specific decisions as well as continuous transformation and adaptation and the forces that shape these changes.

A focus on policy mobility highlights the role of actor groups and individuals in knowledge and policy transfer and learning (McFarlane 2009; Temenos and McCann 2012). It understands the transfer and transformation of knowledge, ideas and models as social processes where actors are part of certain networks and are embedded in specific institutional structures. It hence goes beyond unidirectional learning processes. Policy mobility is strongly linked to the motivations, capacities and circumstances of specific actors and actor groups in their respective contexts. The *how* of policy development and processes of political contestation imply a political dimension of knowledge and policy transfer where actors strategically choose and transform knowledge, regulations and practices that best serve their needs and meet set objectives. Policies may be driven by specific (local, urban or other) political agendas that are predominately locked into a neoliberal sustainability logic that neglects sociocultural and environmental imperatives in favour of economic growth objectives and market regulation (Cook and Swyngedouw 2012). The four city regions discussed in Part II of this book provide very different examples of the role of local, regional and state governments as promoters of or barriers to greening.

In terms of a spatial understanding of the urban, the critical urban geography literature advocates a relational understanding of space and recognition of the "contingent, historically specific, uneven, and dispersed nature of material and non-material flows" (Olds 2001: 8 quoted in McCann and Ward 2011: xxiv). The policy mobility literature relates to the multi-scalar, the fixed and mobile and the territorial and relational character of policies for local and regional sustainable development (McCann and Ward 2010). While policy-makers are usually bound to administrative levels and territorial boundaries and so are many other actors (e.g. practitioners restricted by legislation, codes of practices, etc.), they are inextricably affected by processes beyond the local and urban scale. This perspective understands cities as "emergent translocal assemblages, or moments in more globally extensive flows" (McCann 2011: 144). According to McFarlane (2011: 652), "assemblage does not separate out the cultural, material, political, economic, and ecological, but seeks to attend to why and how multiple bits-and-pieces accrete and align over time to enable particular forms of urbanism over others in ways that cut across these domains, and which can be subject to disassembly and reassembly through unequal relations of power and resource".

A focus on the urban level to deliver sustainable development bears the risk to isolate the local level from other spatial scales through which environmental governance is exercised and to ignore "wider social, economic and political processes which shape sustainability in urban places" (Bulkeley and Betsill 2005: 58; Bulkeley 2005; Gibbs and Jonas 2000). The relational conceptualisation of space from a policy mobility and urban assemblage perspective avoids such local or regional determinism which is at least implicitly underlying research on best practices and good governance. While the approach is spatially sensitive, there is a tendency of policy mobility research to focus on ongoing processes and dynamics (*presentism*) (Temenos and McCann 2013) and to ignore broader time frames (e.g. successes and failures in the past and future potential and limitations) even though there have been exceptions (Clarke 2012). With broader acceptance and application of the concept, more historical and historically situated accounts of policy mobilities are emerging in the literature (e.g. Craggs and Neate 2017). Policy mobility analysis includes a broad range of policy actors, but its analytical focus remains on the development, transfer and implementation of policies and neglects social and environmental values and practices that emerge in parallel or result from policy development and mobility (Affolderbach and Schulz 2016). While urban sustainability policy (embedded in wider governance processes) is a crucial part of green building, there are more dimensions including experiments and initiatives by new actors and actor constellations, socio-technical contexts and aspects related to occupancy and green practices of green building that need to be considered carefully to unravel the trajectories of green building in urban areas.

3.5 Towards an Analytical Framework for Urban Green Building

The brief review of urban sustainability research reveals a number of challenges and limitations that require consideration: the diversity of actors involved in sustainability transitions; the challenge of triple wins which calls for an incorporation of technological, institutional, procedural and other innovations; and the multi-scalar nature of urban sustainability and different spatial conceptualisations of context-specific developments. Following Affolderbach and Schulz (2016) and Haarstad (2016), this book brings together critical work on urban governance, in particular policy mobility, and transition studies to trace the development, objectives and spatial expressions of green building in four city regions. Both Affolderbach and Schulz (2016) and Haarstad (2016) emphasise the complementarity of transition studies, urban governance and policy mobility and highlight the strengths of a conjoined approach in order to "point to and emphasise different aspects of the complex assemblage of institutions, networks and socio-technical artifacts through which urban-low carbon transitions are governed" (Haarstad 2016: 6).

Transition studies provide a heuristic framework that governance-oriented and policy mobility-driven approaches can help fill with life as they trace real, on the

Table 3.3 Comparison of conceptual dimensions of policy mobility and transitions studies (Affolderbach and Schulz 2016: 1950)

	Policy mobility	Transition studies
What?	Mobility/transfer of knowledge Socio-spatial(-political) processes	Knowledge creation Socio-technical processes
How?	Learning, adaptation and mutation	Radical niche innovation
Where?	Relational	Localised
Who?	Individuals and actor groups	Actor networks and institutional structures

ground processes at multiple scales. Table 3.3 summarises the complementarity of the conceptual dimensions of the two approaches. As outlined elsewhere in more detail (Affolderbach and Schulz 2016), a blended approach is well suited to tackle complex processes of sustainability research as they apply to green building. First, policy mobility helps to put into perspective the comparatively strong technology-oriented focus of transitions studies through incorporation of socio-spatial (and in particular political) dimensions, while transition studies offers a broader temporal perspective to policy mobility. A policy mobility perspective reveals decision-making processes that do not necessarily favour or select optimum solutions (only those innovations that successfully budded in protected niches) but highlights the diversity of "mobilized knowledge, transformations and mutations that reflect messy, contested and complex realities" (Affolderbach and Schulz 2016: 1949). It hence emphasises the importance of processes of mobility of knowledge and ideas as much as knowledge creation (innovations) that are sensitive to the local contexts. It further helps identify knowledge and practices that are not being mobilised and transferred to other levels but that yet may be crucial to urban transformation processes. Locally specific practices and values play an important role here as illustrated by high levels of environmental consciousness amongst residents in certain cities (e.g. Portland, Oregon and Växjö, Sweden) versus relative resistance to more sustainable lifestyles in many other places. For example, community-led green developments including strong resident involvement (e.g. through building groups) are exceptions rather than common practice.

Second, and closely related to the first point, sustainability transitions in general and transitions in green building more specifically cannot be simply understood through successful radical niche innovations which tends to nurse ideas around green fixes and technological solutions, best practices and transferable models that are easily propagated as magic bullet. A conjoined approach that includes processes of learning, adaptation and mutation illustrates that transitions are not necessarily unidirectional and predetermined developments but shaped by multidirectional and uneven exchanges of ideas and knowledge between multiple actors. Emblematic cases such as Freiburg's Vauban neighbourhood or the BedZED project in Wallington, London, need to be understood as local-global assemblages that consist as much of external or international influences including best practices and models as well as local interpretations and adaptations including ultimately lived sustainabilities that result from these initiatives. Policy mobility hence questions the assumption in transition studies "that certain best practices, cities, and consultants

'naturally' rise to the top" (McCann 2011, 121) and emphasises the need to understand the socio-spatial conditions that shape the success of new policies (and other innovations). Social networks and exchange platforms such as conferences, meetings and other gatherings attended by key actors involved in green building can shed light on the ways knowledge and ideas travel and are passed on. Knowledge transfer is not always based on careful screening processes but as much driven by actor networks and eventualities which policy mobility scholar trace as they follow key actors through mobile ethnographies. While policy mobility tends to emphasise ongoing processes, transition studies help to broaden the focus by adding historical and forward-looking dimensions.

The third strength of a combined approach relates to spatial conceptualisations that are of particular relevance to urban green building transitions as they help demarcate the urban. Work on (sustainability) transitions tends to emphasise the role of the local, regional or national, while policy mobility follows a relational understanding of space that has more recently engaged with work on urban assemblages. From a multi-level perspective, a relational understanding opens up and blurs "the clear boundaries of niches and regimes, changes the relationship between different levels and disconnects the alignment and hierarchy between distinct levels and spatial scales" (Affolderbach and Schulz 2016: 1951). This implies that innovations (whether new or mutated) are never truly urban or local but shaped through multi-scalar interactions which are as central to shaping urban trajectories of greening as local specificities. Local projects and policies branded and marketed as local leadership often have been influenced as much by models and practices from abroad that have been reviewed and (re)assembled into a local model and influenced by the specific context including collective values and practices (for an illustrative example, see Vancouver's Greenest City Action Plan (Affolderbach and Schulz 2017)).

Fourth, and as already touched upon above, the two perspectives of transition studies and policy mobility are both actor centred but in very different ways. While one focuses on actor networks and institutional structures, the other highlights the role of individual actors or smaller organisational units. Consideration at both levels allows inclusion of a wide range of actors as they are represented in sustainability transitions clearly pushing beyond the frequently biased analysis of technocratic elites and more established institutions and governance bodies. It also highlights the importance of individual pathways that can be much more subjective or accidental as may be assumed. In respect to green building and as further discussed in the four case study chapters (Part II), individuals have been identified as key players in shaping green building transitions. In Vancouver, this includes both political leaders who as individuals have launched ambitious greening policies (a quite common strategy of prestige building and political leadership) and private actors often directed at an external audience around the world. At the same time, thought leaders and scientists, for example, at the University of British Columbia in Vancouver, were identified as influential in shaping an entire generation of professionals in urban design, planning and engineering. In Freiburg, central actors include both research institutions and practitioners, in particular local architects who were involved in early green building experiments (Chap. 5). Green building innovations in Luxembourg on the contrary have been more strongly driven by private investors

including a few visionary individuals who have defined the sector by initiating lighthouse projects (Chap. 8). Rapoport and Hult's (2017) work illustrates the role of private sector architects and consultants in creating, packaging and circulating sustainability norms and best practices at the global scale which impacts on the way local or regional greening initiatives are developed and shaped.

The outlined approach allows a context-specific and spatially sensitive analysis of green building in urban contexts. Rather than identifying models and taxonomies of sustainability approaches, the in-depth case studies of Freiburg, Vancouver, Brisbane and Luxembourg provide rich accounts of trajectories of greening that focus on unique developments including identification of key players, events, initiatives and projects. Following Sayer (1992), the research presented in this book considers context not as background but as a central part to the explanation (though it is not meant to be deterministic). This does not question the transferability of urban greening experiments, practices and ideas but suggests that these are never to be understood as simply transferable models of urban sustainability and greening that are readily available to be replicated but that mobility is shaped by actors, their context and capacity and will be interpreted, shaped and adapted in the process.

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Chapter 4
Methodology

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Abstract This methodological chapter argues for a multisited approach to urban green building transitions driven by the objective to understand different drivers of and barriers behind green building innovations rather than a directed comparison between cases. The approach offers a broader scope of analysis without neglecting the in-depth analysis of the single cases. The chapter presents the interactive research design and discusses the mixed-methods approach applied throughout the exploratory, the main empirical and the validation phase of the research project. Methods include document analysis, stakeholder and expert interviews, media and discourse analyses and interactive formats (World Café, stakeholder workshops). The chapter ends with reflections on the limitations of the approach.

4.1 Approaching Urban Green Building

The conceptual framework presented in the two preceding chapters emphasises the complexity of urban green building innovations in varying geographical contexts. The proliferating literature on urban sustainability transitions mirrors the plurality of methodological approaches taken by different groups of actors. Scholars including Bulkeley et al. (2011) and North (2013) underline that sustainability research needs to take into account this plurality of perspectives and knowledges in order to understand the drivers behind transitions. In the field of green building, the how(s) and why(s) of specific developments in different places seem to play a particularly prominent role given the impact of vested interests and political strategies on sustainability debates (e.g. city marketing) as well as the variegated path developments. The settings of urban green building transitions can be understood as multilayered, highly complex patterns of agency paired with a strong degree of contingency along their trajectories. In an attempt to capture this complexity, the research project employed a qualitative multisited case study approach including an interactive dimension to initiate knowledge cogeneration (Kindon et al. 2007; Preller et al.

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2017). This chapter presents some epistemological arguments for the chosen case study design, description of methods and details on data collection and analysis.

Case studies are primarily led by an intrinsic interest in the particular case which draws "researchers toward understandings of what is important about that case within its own world, which is not the same as the world of researchers and theorists. Intrinsic design aims to develop what is perceived to be the case's own issues, contexts, and interpretations" (Stake 2005: 450). In his seminal paper on case study research, Flyvbjerg (2006) emphasises the value of single case studies both for the in-depth understanding of the respective case and for generalisations that can be drawn from single cases or smaller samples of cases. Accordingly, case studies focus on the particular articulations of a case in a specific context and can be "a small step toward grand generalization" (Stake 2005: 448). The *thick description* (Geertz 1973) of the single case is by no means limited to idiosyncratic analysis alone. It can also feed into broader generalisations. The main advantage of single case studies lies in its capacity to acknowledge the fact that "the determinants of policy outcomes in any given situation are not linear, cannot be pre-determined, and are an empirical question, resolved contingently in specific contexts" (Baker and McGuirk 2016: 6). Only *context-sensitive analysis* (Herrick 2013) can reveal the pertinent factors and contingent elements of a case's trajectory.

The main objective behind the chosen multisited case study approach presented in this book is to gain in-depth evidence from similar, though different, cases in order to extend the range of findings for the four city regions of Freiburg, Vancouver, Luxembourg and Brisbane. Additionally, the thick descriptions of the individual case studies allow at least to some extent for comparison and interpretations that help to trace different pathways and transitions towards green building. In this sense, the multisited case study approach not only responds to calls that have highlighted the importance of more systematic comparisons in urban research (Denters and Mossberger 2006; Ward 2008; Barbier 2015; Robinson 2016). It also helps avoid too isolated idiographic analyses of cities that risk leaving out the relational aspects (see Chap. 3). It contributes to a shift in transition studies research from single sector studies within national economic contexts to the inclusion of different spatial scales (e.g. cities; see Rohracher and Späth 2014) and of more than one innovation or transition context at a time (e.g. the impact of low-carbon policies in different states, Raven and Geels 2010). This multisited perspective offers opportunities for understanding innovation processes not just as socio-technical but also spatial process that acknowledges the mobility of knowledge and the role of learning, adaptation and mutation. The policy mobility debate emphasises the role of knowledge creation and cross-fertilisation between often far away and different places. The four city regions discussed in this book are also characterised by a remarkable number of linkages and cross-references (see Part II).

Furthermore and as described in more detail in the following section, the research involved a second level of case study analysis wherein each case study region was studied through a number of micro case studies. These have been systematically selected (see below) and were used to reconstruct and understand developments in green building in each of the four city regions.

The case study approach was informed by an interactive research design to increase its methodological and topical reflexivity. This included engaging a wide range of local stakeholders in both the conception and the execution of the research design. Inspired by participatory action research (PAR), the project aimed at facilitating knowledge cogeneration between researchers and practitioners (Preller et al. 2017). A key element of this approach is to conceive local experts and interview partners not primarily as sources of factual information and individual narratives but rather as partners who share a certain interest in the project and who can help narrow down and direct the research questions and adapt the research design to the local particularities (Sheridan et al. 2010; Newton and Parfitt 2011).

Participatory approaches have gained momentum over the last decade (Aldred 2011) and have attracted interest from scholars conducting sustainability research. Participatory approaches seek to *co-produce* knowledge through a deliberate and structured collaboration between researchers and the researched. Knowledge co-production was identified as a promising way for the project to address environmental policy and sustainability issues that require "a scientific practice which can cope with uncertainty, with value plurality and with the decision-stakes of the various stakeholders of the problem at hand" (Hessels and van Lente 2008: 744). It is also assumed that participatory approaches increase the utility of research and its practical application (Hessels and van Lente 2008: 741; Martin 2010: 211–212), let alone its socially transformative potential underlined by advocates of action research (Pain 2004).

Participatory research thus challenges traditional concepts of expertise and knowledge generation, predominantly understood as a single-sided knowledge generation in academia and research centres with practitioners being considered as mere recipients of scientific knowledge produced outside their everyday realm and then transmitted from the scientific world for application at a later stage. In contrast, the notion of co-production can simultaneously appeal to both researchers and research participants throughout the research process. From the researcher's perspective, the narrow collaboration with those involved in ongoing transition processes offers deeper insights into the underlying motivations and relevant context conditions. Further, it can reveal individual trajectories, personal networks and underlying value systems of actors. Research participants are able to exchange views and perspectives and learn from other participants as well as reflect on their own positions. Research approaches explicitly labelled as PAR are not only driven by the search for a progressive understanding of the roles of both the researcher and the researched, but also by the ambition to generate results that have an impact on the real world.

The GreenRegio project drew inspiration from these interactive methodologies which were translated into the understanding of *interactive transition research* (Preller et al. 2017) that acknowledges the key role of the constituencies (here the stakeholder communities within the green building sector) for the co-production of new knowledge (Fig. 4.1). The probability that learned knowledge has a direct impact on the respective field is further increased through shared ownership of the research endeavour between local experts, practitioners and stakeholders and invitations to comment and validate preliminary findings.

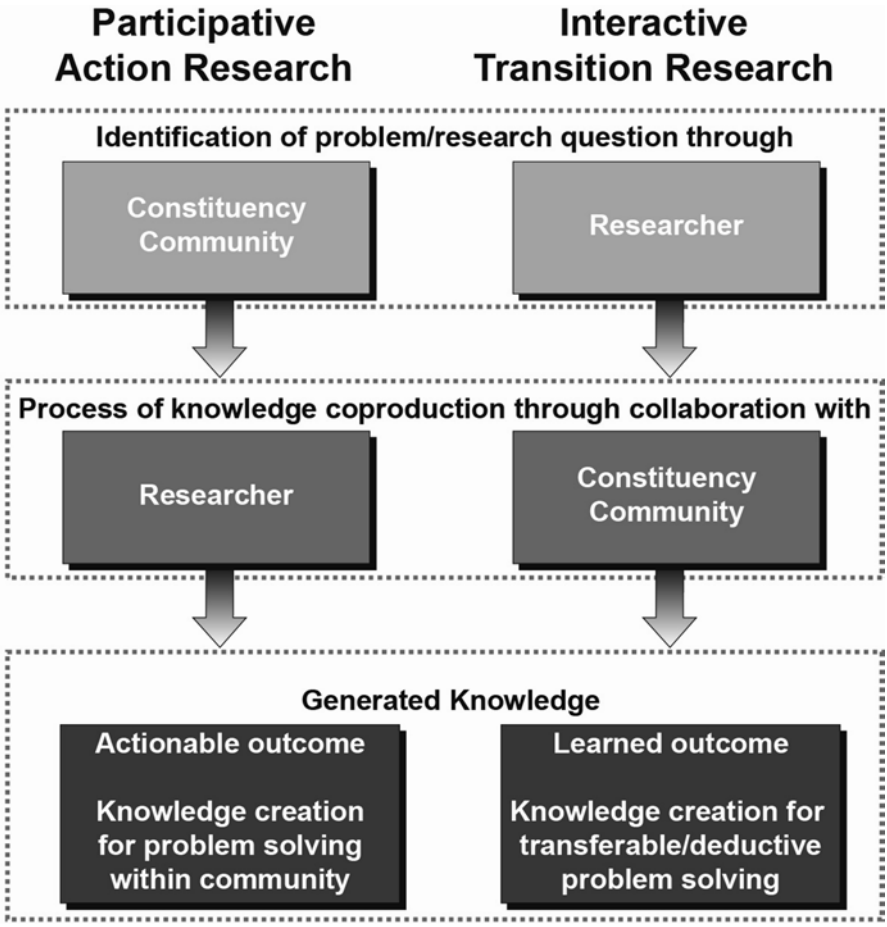

Fig. 4.1 Imperatives and objectives in participative action research versus interactive transition research (Illustration: Ulrike Schwedler, based on Preller et al. 2017: 218)

4.2 Case Studies on Urban Green Building Transitions

Freiburg, Vancouver, Luxembourg and Brisbane are city regions characterised by considerable population growth that places pressure on the built environment, urban planning and the spatial extent of the cities. The four cities responded to these pressures through initiatives of densification of urban structures, in particularly housing, and the development of green building strategies within broader goals of climate change mitigation objectives. The case study regions include two cities that are internationally renowned for their particular efforts and tangible successes: Freiburg

Table 4.1 Key characteristics of the four case study regions (Vancouver: BC-Stats 2016; Metro Vancouver 2013; Vancouver 2016; Freiburg: Statistisches Landesamt Baden-Württemberg 2016; City of Freiburg 2016; Luxembourg: STATEC 2016; WorldBank 2016; Brisbane: Australian Bureau of Statistics 2016)

Case study region	Vancouver (Greater Vancouver Regional District (GVRD))	Freiburg (including Landkreise Breisgau-Hochschwarzwald and Emmendingen)	Luxembourg (Grand-Duchy)	Brisbane (Greater Brisbane and City of Brisbane)
Territory (km^2)	2877 (GVRD) 114 (city)	2211 (region) 153 (city)	2586 (country) 52 (Lux. City)	15,826 (GB) 1367 (city)
Population (2015)	2,513,869 (GVRD) 648,608 (city)	645,818 (region) 226,393 (city)	576,200 (country) 115,200 (Lux. City)	2,308,700 (GB) 1,162,186 (city)
Pop. increase 2000–2015	420,744 (2001–2015) + 20%	21.291 (city) + 10%	136,700 + 31%	528,050 (2003–2015) + 30%
GHG emissions/capita (CO_2 equivalents)	6 tons/capita (2010)	8 tons/capita (2011)	24 tons/capita (2012, including road fuels sold to non-residents)	19 tons/capita (2007)

and Vancouver. Luxembourg and Brisbane show similar growth trajectories as to their demographic and economic dynamics but have more recently established ambitious goals in their respective green building policies. While the scale of analysis for Brisbane, Freiburg and Vancouver was defined by the metropolitan area (or urban agglomeration), in the case of Luxembourg, the constrained size and spatio-functional setting of the Grand-Duchy of Luxembourg resulted in the inclusion of the whole country in the case study. The key characteristics of the four case study regions are summarised in Table 4.1.

While the case studies share a number of similarities, they differ considerably as to their geographical, political, economic and sociocultural settings. While green building initiatives in Freiburg and Luxembourg are increasingly influenced by the European Union's (EU) energy and climate change policies, Brisbane and Vancouver are embedded in a two-tier legislative system (national level plus provinces or states), with less immediate international impetus. Both countries have similar legislative systems based on their status as commonwealth countries and former British colonies. Economic trajectories, legacies from the past and the related political traditions and cultures vary between the four case study regions and influence transitions in the green building sector. Finally, an obvious particularity of the Brisbane case study is the subtropical climate which means that green building initiatives and low-carbon policies have to deal with cooling rather than heating issues. These and other particularities will be discussed in more detail in the respective empirical chapters (Part II).

4.3 Research Design

The research design of the GreenRegio project encompassed a variety of qualitative research methods which varied according to the different project phases. Methods chosen either built on preceding steps of the analysis, or they deliberately complemented other tools and thus allowed for a methodological triangulation (Fig. 4.2). During the exploratory phase, methods included document analysis, exploratory interviews with key stakeholders and a comprehensive actor mapping. Kick-off workshops were inspired by the World Café combined with Delphi-inspired feedback loops. The micro case studies conducted in all case study regions encompassed expert interviews, observations as well as content and discourse analyses. Figure 4.2 provides an overview of the modular structure of the data production and collection approach. The respective methods are further outlined below.

4.3.1 Exploratory Phase

The first phase of the project consisted of preparatory fieldwork on the green building sector in the four case study regions. Exploratory interviews with key stakeholders, the screening of policy documents, press articles and pertinent websites as well as participation in public events were used to establish a preliminary actor mapping of each case study setting. This mapping was a central step towards stratified sampling of potential participants to assure that the sample comprises a balanced set of different types of stakeholders who represented the broadly defined green building sector in the respective region. These actors were invited to the kick-off workshops held in each city region (Sect. 4.3.2).

Observations during the events provided first insights into current dynamics and predominant discourses within the green building sector. Besides the aforemen-

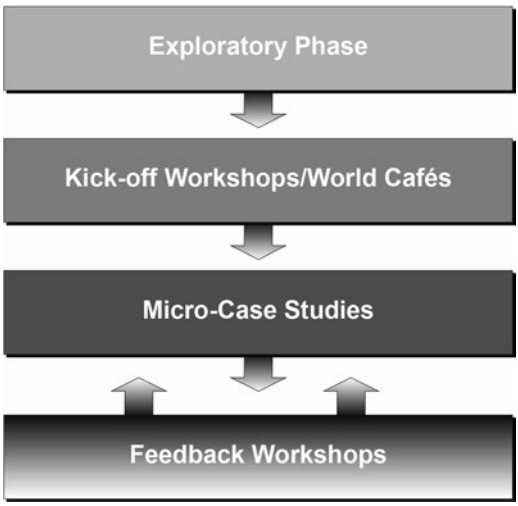

Fig. 4.2 Empirical phases of the GreenRegio project (Illustration: Ulrike Schwedler)

tioned documents, respective legislations and information on funding schemes and industrial norms were gathered and analysed, including—where applicable—the national and supranational (e.g. EU) level. Furthermore, research reports and existing scientific publications on the broader realm of low-carbon policies in the case study regions have been systematically explored.

4.3.2 Kick-Off Workshops and the World Café

In order to both facilitate the cogeneration of knowledge through an interactive research approach and to create a certain degree of co-ownership amongst local stakeholders and practitioners, the so-called kick-off workshops were held in each city at an early stage of the research process. These half-day workshops were organised according to the World Café objectives (Box 4.1).

Box 4.1 World Café (from Affolderbach et al. 2018: 224)
The World Café method developed in the mid-1990s by Juanita Brown and David Isaacs consists of a group intervention that encourages an open dialogue between participants by relying on unconstrained and interactive conversations. It is operationalised by splitting participants across tables into smaller groups where they are invited to tackle a specific question. Participants then progress through several conversation rounds with additional questions, as they are asked to circulate and mix across the different tables (The World Café 2015). The content of each conversation round is documented and passed on to the next group by a stationary table host and eventually complemented by a final plenary discussion to ensure sharing and connecting of the generated information amongst the totality of participants. Through this "recombination" of knowledge (Brown 2001: 3), reflexive processes amongst participants can be initiated and may lead to a collective understanding of an issue. This includes shared tacit knowledge which may contribute to creating joint ownership of the sessions' outcome (Brown 2001; Fouché and Light 2010; Prewitt 2011).

The main objectives of the workshops were (1) to gather different understandings of the transition towards sustainable building, (2) to identify common patterns in terms of particularly significant factors and (3) to capture tacit knowledge, harder to grasp through document analysis or other methods.

Each workshop involved three consecutive discussion rounds focused on a specific dimension of the sustainable building sector following the project's co-evolutionary approach: (1) actors and organisations, (2) building projects and (3) framework conditions (encompassing institutional aspects like legislation, socio-economic aspects, etc.). Based on the experience of the first World Café kick-off workshop, a fourth discussion table addressing challenges and barriers to the development of sustainable building practices was added (Table 4.2).

Table 4.2 Composition and themes of the GreenRegio World Café workshops

Workshop	Participants (+researchers)	Actor types/affiliations	Key topics/foci
Vancouver 8 Nov. 2013	14 (+5)	[8] Architects, engineering and design firms, developers, think tanks, research institutes, NGOs, municipality, energy provider	• History of environmental activism and advocacy (e.g. Greenpeace, David Suzuki) resulting in an environmentally aware public • Strong influence through individual leaders particularly linked to the University of British Columbia • Vancouver-specific urban design and planning • Recent political leadership with strong environmental agenda
Luxembourg 29 Jan. 2014	27 (+7)	[9] Architects, engineering and design firms, private and public developers, interest and professional associations, research institutes, NGOs, ministries (sustainability, economy, housing), national energy consultancy	• Key role of legislation on energy efficiency (esp. EU directives) • Strong technological/ innovation focus • Need for increased streamlining and coordination amongst (public) actors and procedures • Numerous private/corporate initiatives • Call for better advertisement of achievements (building projects) • Overall top-down policy-led approach
Freiburg 12 Feb. 2014	10 (+7)	[6] Architects, engineering and design firms, public developers, research institutes, municipality, energy provider	• Key role of environmental sensitive and engaged population • Good connections and exchange platforms between a wide range of actors (public, NGOs, research centres) • Early (the 1990s) energy efficiency legislation and consequent application in two public developments (Vauban and Rieselfeld) as key motors • Call for thematic renewal and enlargement of green building understanding, and especially a more visionary approach from the policy side

(continued)

Table 4.2 (continued)

Workshop	Participants (+researchers)	Actor types/affiliations	Key topics/foci
Brisbane 27 Mar. 2014	10 (+5)	[7] Architects, engineering and design firms, research institutes, NGOs, municipality, state ministry, regional administration	• Policy discontinuity on different policy levels (policy changes after government changes) • Short-term "thinking" of different industry actors (builders, developers, investors) • Market-based changes towards "greener" office buildings in and around the central business district • Discrepancy in "greening" between the commercial and the residential sector • Dominant forces within Queensland that show little interest in energy saving (e.g. coal industry)

All workshops aimed at keeping a balance between different actor groups according to their relevance revealed through the aforementioned actor mapping. Inevitably, not in all workshops ideal representative sampling could be realised as either some actor groups seemed more hesitant to become involved (e.g. NGOs in Freiburg) or individuals cancelled at short notice. The comparably high number of participants in Luxembourg can be explained by three factors. First, the green building sector has only recently been discovered as relevant for climate change mitigation and other greening strategies (i.e. there is a dynamic that includes a certain enthusiasm shared across actor groups). Second, it is the only case study region where parts of the project team were located and pre-existing networks and contacts with stakeholders facilitated the arrangement of the workshop. Third, some participating authorities and organisations sent two participants to the workshop. A more comprehensive self-reflection on weaknesses and limitations of the research design will be provided in Sect. 4.4.

Though no audio or video records were produced, the World Café sessions were documented by members of the research team taking notes at each table and by collecting the participants' statements written on cards that became part of the respective table minutes (Fig. 4.3). In addition to these detailed minutes, participants have been solicited to do a post-workshop validation by evaluating the single projects identified in the discussions. The data allowed a preliminary ranking of the most relevant initiatives in terms of built or planned projects, regulation and policies, and other activities, including procedural and organisational innovations. Based on these listings as well as own observations and feedback obtained throughout the exploratory interviews, local micro case studies were identified which have been subject to a subsequent in-depth analysis.

Fig. 4.3 Impressions from a World Café table in Freiburg (Photo: Carolin Hulke)

4.3.3 Micro Case Studies

The aim of the micro case studies was twofold. First, they allowed for deeper understanding of the regional particularities and trajectories. In addition, they provided a broader range of articulations of green building innovations and their respective leverage. That is, they allowed to further conceptualise the notion of innovation in sustainability research. In each case study region, five to ten promising micro case studies (Table 4.3) were selected based on the following criteria:

- Pertinence for the respective context (according to stakeholders' evaluation)
- Innovativeness and originality (e.g. whether the activity or project originated from within the case study context)
- Empirical accessibility

The latter comprises the possibilities and limitations of the diachronic perspective applied including, for example, the problem to access reliable information about the early stages of older projects.

The built environment micro case studies capture different aspects of green building including (1) residential and economic uses; (2) socio-political, economic and environmental innovation and objectives; (3) critical examination of flagship projects including lessons learned and lost opportunities; (4) and different timeframes (i.e. completed and ongoing or planned projects). To assess the micro case

Table 4.3 Overview of the micro case studies

	Vancouver	Luxembourg	Freiburg	Brisbane
Policy	(a) Greenest City Action Plan 2020 and Vancouver Bylaws	(a) LUNAZ + certifications privées (b) Förderung vom Wirtschaftsministerium (Innovation, Energieeinsparung) (c) Bildung/Weiterbildung (d) Energieeffizienzklasse A ab 2017 für Neubauten	(a) Freiburg low-energy building standards	(a) Sustainable Development Grants (Brisbane City Council) (b) Brisbane's Plan for Action on Climate Change and Energy
Institutions	(b) LightHouse	(e) Oekozenter Lëtzebuerg (f) Neobuild (g) CRTE—Henri Tudor (h) My Energy	(b) Freiburger Stadtbau	(c) Green Building Council Australia (GBCA)
Built environment	(c) Southeast False Creek (neighbourhood development, flagship) (d) Mall redevelopment and zoning (as strategy, economic and mixed use) (e) Mole Hill Community Housing (residential, social/community)	(i) Solarwind in Windhof (commercial use) (j) Hollerich Village (residential use) (k) Neobuild Innovation Centre	(c) District Rieselfeld (neighbourhood) (d) District Vauban (neighbourhood development, flagship) (e) District Weingarten-West (retrofitting, residential, social)	(d) Brisbane Square (public/commercial) (e) Green Square (residential/commercial, social housing) (f) Common Ground (residential, social housing) (g) Global Change Institute (research)

studies, a multi-method approach was chosen, encompassing semi-structured interviews and document analysis. The raw findings from both methods were then analysed and interpreted through qualitative content and discourse analysis.

4.3.3.1 Semi-structured Interviews with Practitioners and Stakeholders

The interviews built on the preliminary findings from the exploratory phase and the kick-off workshops and were conducted with either selected workshop attendees or further stakeholders and practitioners linked to the respective micro case study. Apart from particular case study related questions, the interview guides mainly consisted of exploratory questions around the triggers for green building innovations, future trends and current obstacles in the given city region. They also helped to identify further interview partners (snowballing) to be added to the sample. In total, 107 interviews were carried out across the four case studies (Vancouver 34, Luxembourg 19, Brisbane 30, Freiburg 24). Interviews were conducted in English, German or French and lasted from 40 min to 2 h. In Vancouver and Luxembourg, some interviewees were solicited twice at different stages of the project (e.g. one exploratory, one more in-depth interview). With a few exceptions, interviews were audio-recorded, fully transcribed (with the help of transcription software F4 and Dragon Dictate for interviews conducted in Freiburg, Luxembourg and Brisbane and professional transcription services for the interview recordings conducted in Vancouver) and annotated by the researchers involved in the interview.

4.3.3.2 Document Analysis

Besides the interview transcripts and related memos, a second important set of data consisted of relevant documents. These ranged from official publications (e.g. legal texts, funding regulation, norms) over policy documents (e.g. strategies, position papers, meeting minutes) and property reports to other media such as websites, brochures or newspaper articles. The composition of the actual samples is further described in the respective case study chapters. These sources were treated similarly to the interview transcripts, following Baker and McGuirk's advice that "an ethnographic sensibility also encourages the researcher to treat documentary materials, such as reports and downloadable PowerPoint presentation slides, as ethnographic artefacts that provide windows into the creation, mobilization, and application of policy knowledge" (Baker and McGuirk 2016: 10).

4.3.3.3 Coding Techniques and Types of Analysis

All textual documents were archived and coded with the help of the qualitative data analysis tools MAXQDA and NVivo. A first coding scheme for a preliminary screening of all sources was jointly developed by the project collaborators (five

main codes, 31 subcodes). Where appropriate, this initial scheme was further differentiated (up to three code levels) and gradually adapted to the needs and particularities of the different case studies. Qualitative content analysis mainly followed Philipp Mayring's (2000) concept of inductive category development and incremental revision and reduction of the categories while working through the texts.

4.3.4 Discourse Analysis

For the two European case studies, a complementary discourse analysis was conducted as outlined in the following. Time restrictions and other resource constraints did not allow rolling this out across all four case studies. Discourse analysis is based on the assumption that the way a problem is articulated and delimited necessarily influences the possibilities to act upon it (Hajer 1995; Hajer and Versteeg 2005; Feindt and Oels 2005; Scrase and Ockwell 2010). While sustainable building is presented as one of the key areas to address climate change and environmental issues at large (UNEP 2011; International Energy Agency 2013; IPCC 2014), the elasticity of the term green building results in very different interpretations and actions similar to definitions of sustainability (Hopwood et al. 2005). Resulting variations of definitions and interpretations provide the rationale for probing assumptions and drivers underlying ideas and practices of green building as they are being developed and enacted in the case study regions. Identification and understandings of the different interests, values and perceptions are used to understand the logics of change towards sustainable building. This approach strongly relies on work in political sciences that looks at policy processes from an interpretive perspective (Hajer 1995; Fischer 2003, 2007; Yanow 2007; Feindt and Netherwood 2011). The starting point here is that knowledge and meaning is subjectively constructed. Discourse analysists are interested in the situated interpretation of a policy issue and how this then influences outcomes. In that regard, they pay particularly attention to the argumentative dimensions of discourse, language being the medium through which humans interact to make sense of the world and hence a particular course of action is justified leading to its implementation (or not) following agreement (or disagreement).

Analyses of language and discourses in social sciences (for an overview, see for instance Keller 2011) all rely on a social constructivist epistemology which is well suited to understand the dynamics and circumstances for a transition towards green building. It allows to capture (1) the diversity of understandings of green building based on different world views, (2) the local contingencies of these understandings based on contextual specificities, (3) how that understanding is mediated and shaped through social interaction and (4) how this has then a physical impact through concrete actions on sustainable building. A discursive approach hence further contributes to addressing some of the criticisms raised on the MLP (see Chap. 2) regarding a better account of geography and politics, notably questions of agency and power, to help illuminate the process of transitioning (Smith et al. 2010; Meadowcroft 2011; Lawhon and Murphy 2012; Raven et al. 2012: as well as Chap. 2 in this book).

Several scholars analyse socio-technical transitions employing a discursive perspective. Smith and Kern (2009) look at the transition storyline in Dutch environmental policy-making and how it is impacted by dominant discourses. Geels and Verhees (2011) address the role of cultural legitimacy struggles in the innovation journey of the Dutch nuclear movement using the concept of framings. Späth und Rohracher (2010) consider the role of guiding visions in shaping the transformation of energy provision in Austrian regions, while Bosman et al. (2014) concentrate on how discursive dominances and shifts in the Dutch energy transition impact regimes. Fuenfschilling and Truffer (2014) also use a discursive analysis of a public inquiry to probe the (de-)institutionalisation logics that ensure the stability and coherence of the urban water regime in Australia and hence its potential for change. Genus (2014) similarly uses insights from institutional theory to address the role of discourse in institutionalising change in the governance of microgeneration in the United Kingdom. Hermwille (2016) situates his work at the landscape level and looks at narratives to help conceptualise how landscape disruptions affect nuclear energy regimes in Germany, Japan and the United Kingdom. Markard et al. (2016) use an advocacy coalition framework and detect change in beliefs systems through interest group publications to analyse energy policy change in Switzerland. In a purely theoretical paper, Pesch (2015) develops a framework to better integrate agency in sustainability transitions via fixations and changes in discursive fields.

Only in a few cases (e.g. Späth and Rohracher 2010), researchers looked beyond single cases by assessing commonalities and differences in discourse patterns across study regions. As described further above, the GreenRegio project deliberately chose a multisited approach to allow for a more differentiated picture, including relational and temporal dynamics. The latter include the historical and geographical contextualisation of emerging discourses, while the former may reveal relational modes of discourse performativity (see policy mobility perspective in Chap. 3).

While all contributions aim to provide a more fine-grained understanding of the dynamics of and rationales behind change (or persistence) in sustainable socio-technical transformations, the diversity of discursive concepts and approaches is striking. Most of them also employ more or less explicitly concepts of institutional theory based on the assumption that norms, routines and practices in the current regime are strongly institutionalised. The discourse analysis applied to Freiburg and Luxembourg follows the same understanding of how and why change occurs (or not) and the extent to which it falls within the structures that preceded it.

In respect to the transformative scope of transitions towards green building, Dryzek's (2013) analysis on environmental discourses provides a framework which distinguishes between four categories according to the transformative power of the implemented changes and the extent to which they break with existing structures (Box 4.2). This framework has been applied to Luxembourg and Freiburg based on the selected policy micro case studies (Table 4.3). The bulk of the discursive analysis relies on government documents as public authorities are central to the green building agenda in both case studies. The corpus includes parliamentary records (Luxembourg) and city council resolutions (Freiburg) as well as policy studies and brochures. These types of government documents were deemed useful because of

their communicative dimension. They deliberately target an audience of elected representatives to convince them to support a particular policy measure or members of the general public to present the benefits of a policy for which public money is allocated. Documents have been collected through the websites of the relevant public authorities using keyword searches. Additionally, the discourse analysis includes programmatic documents from other relevant organisations and local newspaper articles[1] in order to capture a wider scope of the discourse including different voices and changes over time. Here again, the corpus has been assembled through key word searches.

Box 4.2 Environmental Discourse
Dryzek (2013) typifies several competing perspectives on environmental issues, following their departure from the dominant political and economic status quo, which he calls industrialism. He distinguishes two dimensions in that departure, one along the scale of change (i.e. reformist or radical) and another one along how much that change copes with the existing structures (i.e. prosaic or imaginative). He further provides four analytical categories to concretely map the content of a discourse. The two first categories, "basic entities recognised" and "assumptions about nature relationships", retrace the ontologies at the base of the analysed discourse such as the worldview it holds and its implicit understanding of human-nature relationships. The two last categories, "agents and motives" and "rhetorical devices", allow to delve into more details on who defends a particular perspective on environmental challenges, for what reason and with which arguments and tropes. These four categories provide for a concise depiction of the storyline and common thread of the analysed discourse.

The text corpus was scanned and coded following three of Dryzek's categories: "basic entities recognised", "assumptions about nature relationships" and "actors and motives". The resulting text segments were analysed for content and thematically subcoded, with a particular attention towards how legitimacy for green building is created and which arguments are brought forward. Insights regarding the fourth analytical category "rhetorical devices" were also gained during that step. Further care has been taken to uncover inconsistencies, absences and argumentative shifts. Dryzek's categories are carried over in the discourse analysis in Chaps. 5 and 8 (Tables 5.1, 5.2, 8.1 and 8.2).

[1] In Freiburg, articles originating from the main local newspaper (*Badische Zeitung*) were assessed for the period from 2003 to 2015 (electronic archive available since 2003). In Luxembourg, the national press review produced daily by the State's press was explored for the years 2006–2015 (2006 was set as the starting date since the first major piece of legislation dealing with sustainability in the built environment in Luxembourg was passed in the early 2007).

4.3.5 Feedback Workshops

As part of the interactive research design, feedback workshops were held with local stakeholders during the last 3–4 months of the project. These half-day meetings followed three objectives: (a) to present preliminary results to the stakeholders and to receive immediate feedback as to the validity of findings and interpretations, (b) to initiate a debate about the findings which was documented and became an additional source of information for further analysis and (c) to launch the dissemination of the results and to create a certain level of co-ownership amongst the practitioners who committedly accompanied the project over three years. The first two objectives were integrated deliberately based on inspiration from Delphi techniques that cannot only be used for prospective research but also for ex post validation and to trigger stakeholders to share individual views by confronting them with preliminary results (for further details, see Preller et al. 2017).

Most workshop attendees had also participated in the kick-off workshops, but further individuals and institutions identified over the empirical phase were also invited. For budgetary and organisational reasons, these workshops could only be held in Freiburg (29 April 2016) and Luxembourg (8 March 2016). In Vancouver and Brisbane, project newsletters, conference presentations and bilateral meetings were used to reach out to participants and the broader community.

4.4 Reflection on Methodology and Data Quality

As in most research endeavours, the project was limited by material and time constraints that impacted on the constitution of the samples and the depth of some analytical steps. The methodology was challenged by the variety of cases, including intercultural aspects and language-related issues. Interviews and communication was conducted in four languages (English, German, French and Luxembourgish) based on the preference of research participants. The discourse analysis of media articles included three languages.

The selection of micro case studies in the four city regions followed qualitative criteria of relevance and accessibility as well as a theoretical sampling approach in order to make sure that all pertinent themes and sectors were covered. The rather small number of micro case studies identified for each region means there is a certain risk of neglecting or overlooking other relevant cases despite the two-step selection process including stakeholder feedback. Although the actor mapping is aimed at allowing for a most balanced group of stakeholders attending the World Café workshops, the actual mix of participants and their varying capacity to make their arguments heard in the group discussions may have equally led to unintended misbalances (e.g. the underrepresented NGO sector in the Freiburg and Luxembourg workshops or the almost missing corporate sector in the Brisbane case). However, it is hard to assess the potential impact of these misbalances on the later choice of case studies. The feedback workshops confirmed case selections and findings but could

have resulted from a self-referential bias of those involved due to the large overlap of participants in both rounds of workshops. At a more analytical level, the discursive approach practised in Freiburg and Luxembourg has shown promising results. This technique would have deserved both being applied to all four cases and inclusion of a larger and more historical text corpus.

Part II of this book provides an in-depth analysis of the data collected for the four city regions. A dimension deliberately omitted in this project due to time and resource constraints is the user side including the residents' perspective on green building innovations. Aspects that deserve attention in future inquiries include the ways in which users adapt and change in response to green building and their practical experiences with green buildings (e.g. technology used in passive houses), more general aspects of quality of life and user satisfaction but also aspects of social justice and related discourses (e.g. in the context of affordability debates).

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Part II
Practices and Contexts

Chapter 5
Freiburg: The Emblematic Green City

Sebastian Fastenrath and Bérénice Preller

Abstract The City of Freiburg in Southern Germany is seen as a model case of urban sustainability in general and green building in particular. It features a high density of research institutions focused on alternative energy, strict sustainability policies including Freiburg's energy standards, early pioneer projects in green building and large-scale sustainable greenfield and brownfield neighbourhoods. Driven by concerns around renewable energy, local experiments with alternative and green buildings can be traced back to the late 1970s. Freiburg's green neighbourhoods of Rieselfeld and Vauban have attracted international attention since their development in the 1990s. This chapter discusses these developments within the local context of an alternative milieu characterised by engaged and environmentally conscious citizens, a concentration of support institutions and strong political will. While Freiburg's green legacy is largely ascribed to bottom-up processes linked to strong narratives of this alternative milieu, Freiburg's recent greening policies have become more entrepreneurial and outward facing. This marks a shift in Freiburg's green building transition away from civic initiatives focused on the provision of liveable and sustainable neighbourhoods for the local population towards more top-down initiatives of city branding and competitive positioning at the supra-regional scale that risk neglecting social objectives in favour of economic and environmental dimensions of green building.

5.1 Introduction

The City of Freiburg im Breisgau (hereafter referred to as Freiburg) is internationally recognised as a forerunner of sustainable urban development and a leader in environmental protection and energy efficiency. The growing city of Freiburg has a population of 226,000 (2015) and is located in the southwest of Germany close to the borders to France and Switzerland in the state of Baden-Württemberg. Situated at the foot of the picturesque Black Forest and hilly vineyards, the city is a designated

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Fig. 5.1 Freiburg in 2014 (Photo: Sebastian Fastenrath)

destination of nature and outdoor lovers. Retaining the natural assets of the city has been an important goal of Freiburg's population and all political parties (Fig. 5.1).

Over the last 20 years, Freiburg received a number of national and international awards for innovative sustainability projects and policies, including the presentation of the Vauban neighbourhood as a best practice case at the UN-Habitat II Conference in 1996 (Bichard 2014), which played a key role in putting the urban dimension of sustainability on the agenda (Ghorra-Gobin 2008). Since the 1990s policy-makers, practitioners and researchers from all over the world have been keen to visit the city's green flagship projects such as the eco-districts Rieselfeld and Vauban and the recently renovated high-rise buildings in the Weingarten district. Energy-efficient building and construction have developed into a core element of Freiburg's climate change adaptation policy and its image as Green City (Fastenrath 2015). Since 2002 Freiburg's local policies are driven by a Green Party Lord Mayor and the first Green mayor in a larger German city.

There is increased interest in investigating Freiburg's sustainable urban development. Key topics include urban planning approaches (Medearis and Daseking 2012; Hamiduddin 2015), actor constellations in local climate protection (Sennekamp 2013), sustainable policy-making (Mössner 2015a, b; Kronsell 2013), aspects of urban energy transitions (Rohracher and Späth 2014; Späth and Rohracher 2011) and transportation (Buehler and Pucher 2011). The special role of Freiburg's low-energy building approaches is prominent in a number of these contributions, and its evolution has been further described by Fastenrath and Braun (2016). While numerous textbooks such as Peter Hall's (2014) *Good Cities, Better Lives* mark Freiburg as best practice example for urban sustainability ("the city that did it all"), several

contributions have looked more critically at the neoliberal tendencies of Freiburg's sustainable urban policy-making processes. Raised concerns range from the social implications of green policies (greenification) over the past decade (Mössner 2015a; Freytag et al. 2014) including the criticism that social aspects such as accessibility to housing are the poor cousin of the sustainability trio (Hamiduddin 2015; Kronsell 2013; Klus 2013a) to a lost momentum in respect to sustainability innovations (Mayer 2015). To better understand these two sides of the same coin, this chapter aims to explore key aspects within Freiburg's green building pathway.

The insights presented in this chapter are based on empirical results gained through two stakeholder workshops, 27 interviews with experts from the public and private sector involved in green building in Freiburg and secondary sources including a content analysis of a selection of Freiburg's City Council decisions (Gemeinderatsbeschlüsse) (see Chap. 4). While the data collected originate from a range of different sources, they appear to present a coherent and unchallenged account of the successful development of Freiburg as a best practice case in urban sustainability since the mid-1970s. Green policy actions have overall proven successful for Freiburg, both economically and in terms of quality of life as illustrated by a number of green awards (FWTM 2014), best practice publications (Buehler and Pucher 2011; Frey 2011; Bichard 2014; Hall 2014) and the international attention the city receives (Röderer 2007; City of Freiburg 2008). Over the years industry stakeholders and the city administration developed and polished a storyline that is now one of the city's main marketing arguments. The quotes and statements provided hereafter are to be considered in that light. The policy developments at stake have not occurred as smoothly as they are presented today, and the chapter seeks to disclose hidden and underlying discourses and debates where they were apparent. At the same time, the analysis presented here is also dependent on the historical sources used which are mainly official policy documents and City Council decisions and as such relay the dominant political will.

The chapter is presented in two main parts. The first part of this chapter retraces the historical development of Freiburg's green building policies as they have been presented to the authors. It looks at what is without doubt a very specific and rich context of experimentation with specific building projects and policy initiatives including the neighbourhoods of Weingarten, Vauban and Rieselfeld (Fig. 5.2). The second part uses a discursive perspective to untangle how and why this rich tradition of green building initiatives directed at mitigating climate change in the building sector has nowadays become an uncontested narrative serving a neoliberal and consensual political practice of Green City making and marketing.

5.2 Green Building Pathways in Freiburg

The case study of Freiburg provides the rare opportunity to trace back urban transition pathways in the residential building sector for over 40 years. In Freiburg, energy-efficient building and construction came into being as a niche phenomenon in the 1970s and 1980s and have developed into mainstream policy and practice.

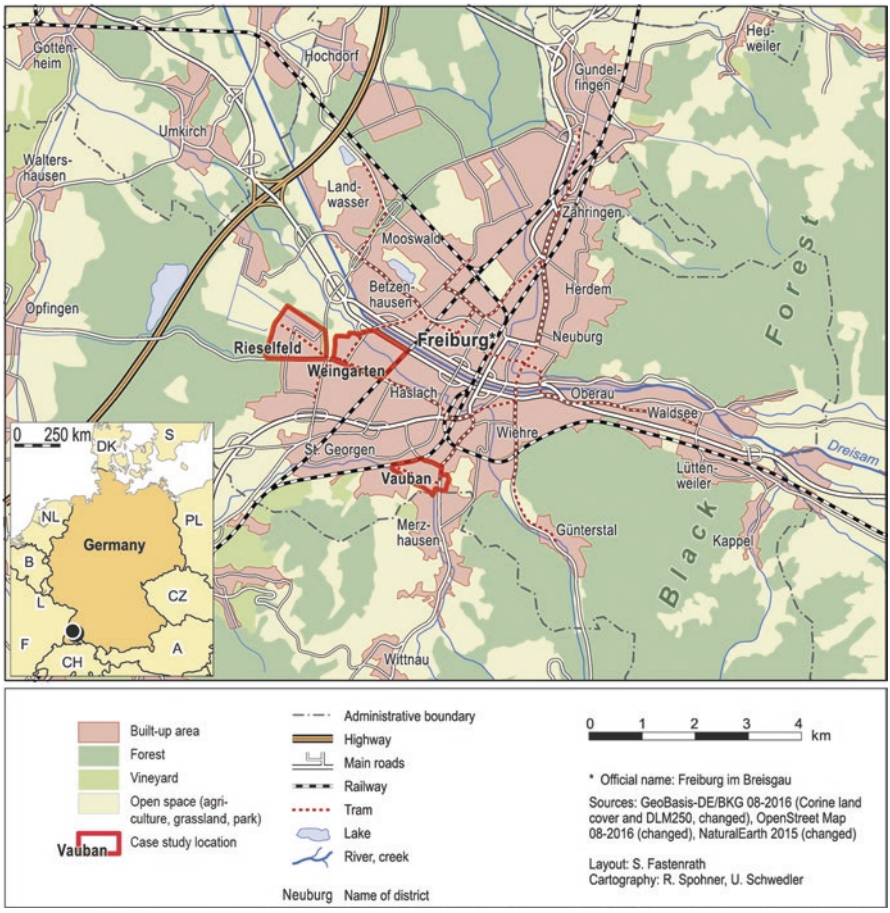


Fig. 5.2 Case study locations in Freiburg (Cartography: Regine Spohner and Ulrike Schwedler)

Today, all new residential building projects are affected by the city's strict low-energy requirements which almost meet the high-energy performance standards of the passive house[1]. Similarly and following the success on housing, energetic requirements towards commercial buildings have also become more stringent. Tracing back this long-term sustainability pathway in Freiburg's building sector, two main directions can be identified. First, an initial bottom-up path, based on niche activities from the 1970s to 1990s and second, a top-down approach based on regime initiatives essentially driven by continual political will and a dedicated city administration since the 2000s.

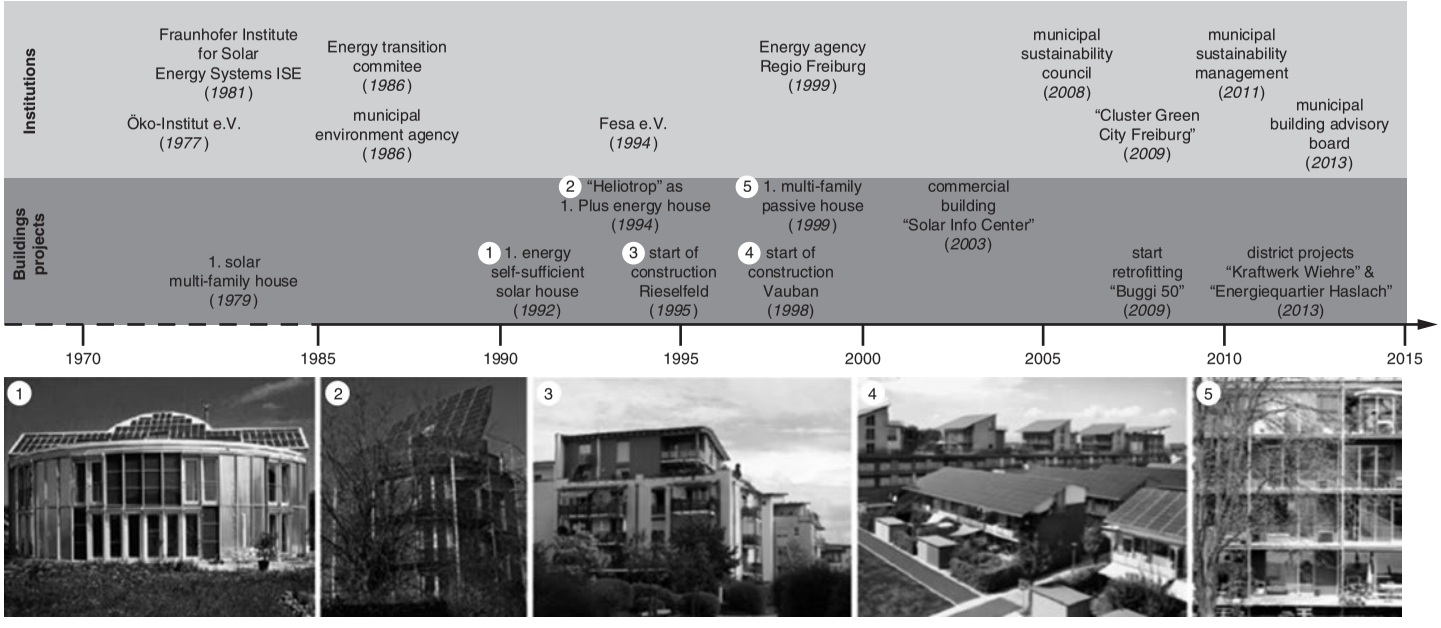
[1] Passive house (*Passivhaus* in German) is a voluntary high-energy efficiency building standard. Based on highly efficient insulation and heat recovery, passive houses require an annual heating and cooling demand less than 15 kWh/m^2.

5.2.1 The Rise of Freiburg's Green Energy Scene

The origins of Freiburg's green building pathway have been dated back by many respondents but also in the city's own brochure (FWTM 2014) to the 1970s when a heterogeneous group of environmental and anti-nuclear activists successfully protested against a federal state government planned nuclear power plant in Wyhl, a small community located 20 km away from Freiburg. The protest brought together students, farmers, conservatives and social democrats and led to a strong bottom-up dynamic. Despite the heterogeneity of motivations amongst protesters, which initially related primarily to conservationist ideals (Zhu 2008), many interviewees and authors (Frey 2011; Späth and Rohracher 2011) as well as Freiburg's city authority (City of Freiburg 2011c) highlight the influential role of these protests as the birth of the region's environmental movement. A representative of the city's planning authority (Frei10) links the events to the green energy focus arguing that "in this region this *energy scene* has been established. As a result of the protests these people thought about the energy supply of the future."

Through this account, Freiburg's sustainability concerns and policies are presented as bottom-up and citizen-driven but also as innovative due to their early grounding along key international climate governance events like the work of the Brundtland Commission. As a result, the environmentally sensitive scene has become the legitimatising cornerstone of all the following discussions and experiments on energy savings and alternative energy production. To a point, this foundational story has become somewhat of a *topos* every stakeholder seems compelled to mention. The key role of the environment and energy movement was then embodied by architecture pioneers and staff of newly founded research institutes in Freiburg who started to adopt and develop experimental energy-efficient building and construction approaches. Early adopters in the region installed prototypes of solar panels on their roofs (Frey 2011); others experimented with solar building designs. First experimental demonstration projects included the Solarhaus which was realised in 1979 (Fig. 5.3). This multifamily building was one of the first low-energy projects realised by the Freiburger Stadtbau, the municipal property developer and main housing provider. As Fig. 5.3 illustrates, a number of important demonstration projects followed, with a particularly high dynamic in the 1990s. Key actors, such as the solar architect Rolf Disch, were repeatedly named as pioneers and central to Freiburg's energy and environment scene which consisted of informal and formal links between environmental activists, pioneers and researchers as well as citizens interested in environment and energy topics.

A number of working groups, organisations and research institutions were founded in this context, such as the Institute for Applied Ecology (Öko-Institut e.V.) and the Fraunhofer Institute for Solar Energy Systems (ISE). The Fraunhofer Institute, initiated by Adolf Goetzberger, another solar pioneer, develops technologies for solar energy production and energy-efficient buildings. The former working group on solar building within the institute was specialised on applied research in



Photos:
Fraunhofer ISE (1), C. Hulke (2), S. Fastenrath (3), Rolf Disch SolarArchitektur (4), Gies Architekten (5)

Fig. 5.3 Key institutional actors and building projects in Freiburg (Illustration: Ulrike Schwedler)

the field of energy-efficient building and construction. In 1992, the institute was the first to demonstrate that an energy self-sufficient solar building was technically feasible. Just two years later, Rolf Disch built the Heliotrope, one of the world's first plus-energy buildings (Fig. 5.3). This locally based knowledge creation through learning by doing and experimentation with new technologies and materials was crucial for later transition processes. Through this account on the development of Freiburg's greenness, the city is presented as unique environment for research, innovation and technology usage characterised by favourable knowledge proximity, especially in the context of energy-efficient building.

A further key turning point for sustainability transitions in Freiburg was the nuclear disaster of Chernobyl in April 1986. Freiburg's City Council and the city administration frame their drive towards urban energy transitions as an active response to citizen concerns in light of this event (City of Freiburg 1999; and interview with a representative of the Energy Agency, Frei08). Freiburg's newly established environmental protection authority outlined a long-term oriented communal energy concept which was based on three pillars: energy conservation, production of renewable energy and the development of environmentally friendly technologies. The pillar of energy conservation was strongly linked to energy-efficient building design and effective insulation of buildings (City of Freiburg 1997b). In a series of regular meetings and discussions, the semipublic energy agency (*Energieagentur Regio Freiburg GmbH*), supported by experts of the local energy scene, developed the city's climate action plan (*Klimaschutzkonzept*).

Altogether, this narrative around a strong local energy scene and local resourcefulness in particular in respect to expertise and knowledge resonate with dimensions of Noel Longhurst's (2013) concept of an *alternative milieu.* The concept provides a theoretical heuristic to better understand the formation of particular geographical places with a density of alternative institutions, including "localised cultural norms, values, worldviews and networks [that create] socio-cognitive spaces for experimentation" (Longhurst 2015).

5.2.2 Policy Pathways of Low-Energy Building Transitions

In the early 1990s, the debate about energy efficiency and environmental protection coincided with an enormous demand for housing in Freiburg (former City employee, Frei09, Chamber of Commerce representative, Frei15). The issue was not necessarily new as Freiburg had already seen a strong alternative housing movement that occupied buildings since the mid-1970s and early 1980s in order to raise public awareness on accessibility and shortages issues, especially for students and low-income households (Klus 2013b). Together with the aforementioned rise of the energy movement, the momentum for alternative housing projects as well as sustainability and urban development projects in Freiburg is

presented as emerging from this backdrop (Klus 2013b: 131; Müller 2015; Zhu 2008). Strong interactions hence occurred between a niche driven bottom-up movement and politicians who were forced to provide residential space. A long and fierce public debate occurred around the greenfield project in Rieselfeld. Freiburg's energy and environment movement as emphasised by a Chamber of Commerce representative (Frei15) but also City Councillors linked to the greens and social democrats was indeed sceptical towards this new development on a former sewage farm outside the urban fabric (Böhme 2009). Their opposition was mostly based on concerns about urban sprawl and its environmental outcomes and met by support amongst the population. Nevertheless, following a long debate about ecological and social responsibility, the City Council's decision to develop approximately 80 ha of the Rieselfeld area went through in 1991 (Zhu 2008). An interviewee (Frei08) involved in the conflict at the time explained that this decision was a result of tough bargaining processes, as the Lord Mayor was forced to make concessions following the strong opposition of citizen movements and experts in the field of environment and energy: "And concessions meant for us: Okay, let us talk about energy and environmental requirements in this new development area."

The 1992 bill towards a low-energy building regulation in the City Council applied by the Green Party and the social democrats in Freiburg (City of Freiburg 1992) is presented as the logical outcome of this bargain driven by bottom-up pressures and citizen engagement of a particularly environmentally sensitive scene. In June 1992, after approval of the proposal by a working group composed of different city authorities (building administration, environment protection agency) and external experts, a large majority of City Councillors voted for the Freiburg low-energy house (FR-LEH) standard. Freiburg introduced its own energy requirements for buildings as one of the first cities in Germany to do so by making use of the flexibility municipalities are granted in setting specifications to building permits in their land use and construction plans (Bebauungspläne) (see Box 5.1 for a brief overview over bylaws and planning authority in Germany). This policy action was widely viewed as path-breaking and an important milestone in the transitions of Freiburg's building sector by representatives of the city and related agencies (Frei08, Frei09, Frei10) and research institutes (Frei07). The introduction of the FR-LEH standard can be understood as the beginning of a long-term policy pathway. The standard for new residential buildings on public land required a maximum 65 kWh/m^2*a for heating energy consumption which was significantly stricter than the federal building regulations at the time (City of Freiburg 1992). The main differences compared to conventional building regulations by federal law were the improvement of the Freiburg standards required in terms of the thermal insulation of the building envelope, the avoidance of thermal bridges and the optimisation of the use of passive solar energy.

Box 5.1 Planning Principles in Germany
In Germany's legal system, local planning is dealt with at two different regulatory levels, the federal and the municipal level (while the Länder only indirectly influence local planning through their regional development plans). At the national level, the Federal Building Code (Baugesetzbuch BauGB) sets the formal framework for the planning instruments that municipalities across Germany can use. In addition, the Land Use Ordinance (Baunutzungsverordnung) specifies further details such as actual building sizes, land use patterns and urban density targets. Within this framework, the municipalities dispose of a high degree of autonomy for their local planning as long as it complies with the federal rules. In its zoning plan (Flächennutzungsplan) and its land use and construction plans (Bebauungspläne), a municipality defines the spatial land use pattern and building coverage and determines the types of built-up areas. As the land use and construction plans are the only instruments that have an immediately binding character for individual landowners, they formally can be qualified as bylaws that transpose both the superior levels of planning and comprise individual specifications for the respective neighbourhood or district. The latter may encompass technical parameters as to the type and size of buildings, materials used, roof shapes and inclinations, etc. They set binding criteria for obtaining a construction permit which is granted by the municipality, too.

5.2.3 Rieselfeld: Learning by Doing

The FR-LEH standard was first adopted in practice in some smaller developments in 1993 and 1994. However, the large Rieselfeld neighbourhood development (Fig. 5.2) was the first crucial test bed for the Freiburg energy standards and according to a city representative (Frei10) a "playground for these people which already had detailed thoughts" about innovative niche building projects. Freiburg's building regulations were implemented in private law contracts between the city administration and land purchasers in Rieselfeld. Within the framework of German federal building regulations (Box 5.1), this process was challenging because energy requirements at the time could not be fixed in urban development or zoning plans. As a result, the city's building authority was responsible to review the targeted energy consumption as part of the building permit. Rieselfeld, planned for more than 10,000 inhabitants, has been one of the largest residential development projects in the federal state of Baden-Württemberg. In 2010 more than 9200 inhabitants occupied the 3500 apartments developed by over 120 private building owners and investors. Following the model of a city with short distances (Medearis and Daseking

Fig. 5.4 Multifamily housing in Freiburg Rieselfeld (Photo: Sebastian Fastenrath)

2012), the city planners in charge sought to design a compact, functional and socially mixed district with convenient access to the city centre (Fastenrath 2015). The district was developed in a predominant block structure, with buildings heights of four to five storeys clustered around inner yards (Fig. 5.4). The lots were deliberatively kept small and care was further taken to avoid the sale of adjacent lots to the same type of investors in order to secure a social and ownership mix (City Planner, Frei13; Back 2005). Land was sold progressively through four building phases to allow the incremental financing of the infrastructure without burdening the city's budget (Müller 2015). The city administration further set up a cross-sectoral project group composed of city employees delegated from different departments who were in charge throughout the development until 2010. It was mirrored by a dedicated and cross-party working group at the level of the City Council to facilitate political decision-making. Participation has also been strong throughout the development as a citizen council was involved from the planning stages onward and later pursued through a very active citizen initiative (Zhu 2008). The city administration set up and financed the K.I.O.S.K project as early as 1996 which stands for contact, information, organisation, support and culture (Kontakt, Information, Organisation, Selbsthilfe und Kultur). This contact point was intended to build up social ties within the neighbourhood from its early days onwards (Back 2005; Müller 2015) and has been later taken over by a citizen initiative which still is a key rallying point for information, discussions but also cultural offers within the neighbourhood.

The energy requirements of the FR-LEH 1992 were integrated late and abruptly, after the basic planning of the district based on a planning competition held in 1991 was already completed (City planner, Frei13). This resulted in challenges in applying the energy requirements to the block structure, as a leading Freiburg-based architect (Frei14) explained: "For example, in the north-east end of a block, it is of course always extremely difficult to reach high energy standards. Large areas of the building do not have energy input from the solar energy or low energy input." One city employee and member of the project group (Frei19) recalled how sample tests conducted after the first building phase in Rieselfeld from 1995 and 1996 demonstrated that some buildings had not reached set requirements. A planner (Frei14) in charge at that time explained that it was indeed a challenge and pioneer work to integrate the new energy requirements into the planning process: "No one knew how to do that, no architect, no planner, no heating engineer, no developer". Accordingly, members of the project group Rieselfeld (Frei13, Frei19) described the principle of the planners in Rieselfeld as "communication instead of sanctions". The head of the Rieselfeld project group (Frei19) argued that this approach helped to evaluate challenges, guided learning processes and helped to transfer these into feedback loops for further improvements of the standard in later building phases.

Apart from technological challenges, local real-estate developers and investors articulated serious concerns linked to increased costs and the financial sanctions foreseen in the contracts during the first land sale phase. The Rieselfeld project lead (Frei19) explained that the critical voices of developers finally went silent when a large institutional investor supported the development. He described the point when "an insurance company bought a larger lot in Rieselfeld [and] said: We do it now, we are going to build" as an important breakthrough. As a result, the critical local real-estate developers finally started their investment and used low-energy building as a marketing tool as confirmed by a number of respondents (Frei03, Frei10, Frei13, Frei15).

In addition to the role played by the large investor and under the pressure of having to sell sufficient plots of land to secure funding for the infrastructure, the city administration was keen to sell lots to building groups (Baugruppen), especially during the third and fourth building phases (Müller 2015). After successful early pioneering projects in Rieselfeld such as the Blue House (Blaues Haus), the planning group in charge saved options on lots for building groups and even proactively contacted architects to offer them lots to initiate these kind of projects (Müller 2015). As a result the neighbourhood counted 90 building groups in 2010 (City of Freiburg 2010b), which the Rieselfeld project lead (Frei13) and a building practitioner (Frei20) considered having significantly helped building owners to save costs during the construction process. As such, the building group practice has brought positive social effects that may have helped to counterbalance the fact that the city could not build as much social housing in Rieselfeld as initially planned, due to policy changes at the state level (Müller 2015). One key actor (Frei20) resumed that these bottom-up initiated projects reduced costs for buyers by up to 25% compared to similar projects realised by developers. This early adoption of building groups in Rieselfeld can be interpreted as an important stepping stone for further collaborative building projects in Vauban.

5.2.4 The Eco-District Vauban: From Barracks to a Low-Energy Neighbourhood

The new district of Vauban, designed to house 5000 residents, has been developed on the former site of French military barracks, following the withdrawal of the French army from Germany in the 1990s. From the beginning, Vauban received international attention as a model district for urban regeneration and sustainability. For example, in 1996 the district was selected as best practice example for citizen participation in urban development on the UN Habitat II conference in Istanbul (Bichard 2014). The Vauban planners, but also builders, specialised engineers and architects benefited from learning processes in Rieselfeld. "Rieselfeld was a sort of icebreaker. We went in its footsteps afterwards", a leading planner for the Vauban district stated (Frei18). The practised concept of learning by planning in Vauban was considered as an important success factor by the Vauban project lead (Frei18). Similar to the Rieselfeld development, a key goal of the city planners was inclusive citizen participation during the development of Vauban (see also Kronsell 2013). Similar to Rieselfeld, a citizen association, the Forum Vauban, was actively involved in the conception of the development plan of the Vauban district and further played a key role in promoting the building group model amongst interested residents. The Forum notably provided information, advice and meeting rooms within the frame of its public campaign advertising the planned neighbourhood in 1995 (Hamiduddin and Gallent 2016; Müller 2015; Sperling 2013). Through a strong focus on environmentally friendly building solutions, the Forum Vauban was further instrumental in pushing for stricter building standards up to the passive house level. The project lead (Frei18) again emphasised bottom-up processes: "[…] the first people came, who were interwoven with these green thoughts, much more than we were in the city administration, who said: Why are we doing low-energy buildings? Let us build passive houses in the entire area."

The City Council decided against a compulsory new passive house standard but supported more ambitious homeowners and developers in Vauban by giving them preference in the land purchasing procedures (City of Freiburg 1997a). As a result, some areas in Vauban were developed according to an unofficial improved or stricter FR-NEH 1997 standard. These buildings typically require around 30 kWh/m^2*a based on passive house elements such as higher-energy efficiency through insulation, triple-glazed windows, avoiding building shadings and ventilation systems with heat recovery (City of Freiburg 1997a). At least 200 units were built with de facto passive house standard in Vauban including the first multifamily passive house in Germany (see City of Freiburg 2014a). Yet, and as discussed by Späth and Rohracher (2015), the high share of passive housing which is nowadays one of the central features in Vauban's reputation was not the straight forward outcome one could expect given the city administration's environmental objectives. As the city also pursued its district heating policy, the house builders that had chosen to invest in passive housing were at the same time required to pay the high fix price for connecting to a district heating system they would barely use (Späth and Rohracher

2015: 275–276). The citizen's initiative Forum Vauban became particularly involved in relaying the resistance to be connected to district heating by the affected house builders. Eventually, the city agreed upon setting exemptions despite an initial reluctance based on arguments around the critical mass needed for an efficiently functioning district heating infrastructure. As the attached conditions were particularly burdensome though, most of the involved house builders still ended up with a district heating connection (Späth and Rohracher 2015: 277). This example illustrates how, despite a shared vision, multiple interests, (infrastructure) path dependencies, contestations and power issues are shaping sustainability transformations.

In addition to passive houses, a plus-energy neighbourhood is part of the Vauban district. The so-called solar settlement, finished in 2006, was initiated by the solar architecture pioneer Rolf Disch. Based on the experience of previous projects such as the Heliotrope, Disch developed the neighbourhood as an ensemble of 59 multi-storey townhouses and a commercial building named the Sun Ship (Fig. 5.5). All buildings use a wooden construction and environmentally friendly materials. Photovoltaic systems on the roofs are installed on each building with an overall output of about 445 kW peak per year. The generated electricity is fed into the municipal power grid (Rolf Disch SolarArchitektur 2016). The solar settlement is an internationally recognised demonstration project and remains a key tool for Freiburg's city marketing as a Green City.

Fig. 5.5 The Sun Ship (top left) and Solar Settlement (bottom left), Vauban house (right) (Photos: Sebastian Fastenrath)

A representative of the city planning authority (Frei10) argued that the ambitious developments in Vauban were important for later policy actions: "[…] there was this effect that the city administration and the City Council became more courageous because of these flagship projects such as the solar settlement and privately initiated passive houses in Vauban". The political support and the incremental changes of the building standards are again presented as a result of strong bottom-up processes in Rieselfeld and Vauban. Approximately 5000 housing units were realised according to the standards FR-NEH 1992 and 1997 in the two eco-districts. An interviewee and member of the Chamber or Architects (Frei14) argued that "the standards in Vauban and Rieselfeld were heavily promoted by the people who wanted to build there. […] these expectations were brought from the outside into politics." Another interview partner and city employee resumed in a similar way:

> I think the standards came to fruition because there were two planned large developments. So I mean, I can introduce a standard and then I build here and there but that's nothing. It is strongly related to Rieselfeld and Vauban. And in Vauban it is special, because the people there thought ecological anyway, and then built passive houses voluntarily. (Frei09)

Building upon the successful implementation of the standards described above as well as the evolving legislation at the national level, Freiburg's City Council approved the gradual amendments for two even more stringent building standards, the Freiburg efficiency house 40 and 60 (*Freiburger Effizienzhaus*, FR EH 40 & 60) at the end of the 2000s (Fig. 5.6). The more ambitious FR EH 40 was set for building projects by the city's own housing provider, the Freiburger Stadtbau GmbH, and six smaller pilot projects on city owned land. This standard was comparable to the KfW 40 house, a standard attached to public funding availability from the German government-owned development bank (KfW) that requires passive house elements such as low heating energy consumption based on high-efficient insulation, triple-glazed windows as well as a ventilation system with heat recovery.

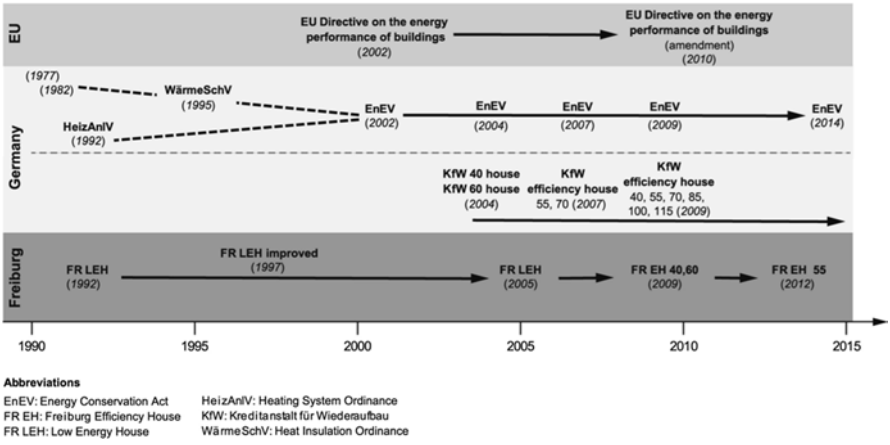


Fig. 5.6 Building regulation pathways: EU, German federal government and City of Freiburg (Fastenrath & Braun 2016: 9)

The second standard, the FR EH 60, is another example of a path-breaking policy innovation as for the first time local energy requirements were prescribed for building projects on private grounds through urban planning contracts (Städtebauliche Verträge). This novelty was possible after the City Council voted for a new local planning policy (Freiburger Baulandpolitische Grundsätze) which settled aspects as planning procedures, financing or the usage of solar energy (City of Freiburg 2009a, b). Since then, solar and passive building design aspects have been continually incorporated in Freiburg's land use planning processes (see Hoppe 2013).

These successful policies and projects in the development of green building should though not occult more problematic aspects, notably the continuous issues of housing affordability and high-priced rents in Freiburg (Klus 2013b), including the aforementioned eco-neighbourhoods which were built to resolve the situation. Vauban, for example, has turned into one of the most sought after and accordingly expensive neighbourhoods in Freiburg (Mössner 2015b) with real-estate prices of up to EUR 3.958/m^2 for existing dwellings in 2016 compared to the Freiburg average of EUR 3.300/m^2 (Höhl 2017). Several authors have further highlighted the processes of social selectivity (Hamiduddin 2015) leading to a relatively homogenous tenant structure especially in Vauban (Freytag et al. 2014), which mainly consists of middle class, educated families with young children. While this is in part a result of the physical characteristics of the neighbourhood, notably the car-reduced and sustainability aspects, Hamiduddin and Gallent (2016) further put forward the high share of building groups as one contributing factor.

> The opportunity for self-selection (and deselection) was an important part of the social motive for building groups. […] Tenant participants believed that greater community cohesion would come from the collaborative nature of building groups from the outset. In reality, such enduring cohesion was found to form between households with similar educational backgrounds, similar values, and those occupying broadly the same socio-economic class (Hamiduddin and Gallent 2016: 375).

The tendency towards homogeneity is a general issue of building groups which Müller (2015: 263, 341–342) attributes to the fact that such groupings occur on a voluntary basis according to a range of attraction criteria like sympathy and similarity amongst members. In addition, Müller (ibid) who analysed the building group phenomenon in Rieselfeld with regards to the contribution of this type of building organisations to sustainable neighbourhoods found that building group members tended to be more engaged and represented within the neighbourhood's participatory structures than other residents, hence providing them with more steering opportunities.

Nevertheless, Vauban and to a smaller extent Rieselfeld have indeed also provided opportunities to alternative building practices in the form of aforementioned building groups but also through cooperative housing. Especially in Vauban, the beginning of the development saw the squatting of some of the former military barracks in opposition to their demolition. After long negotiations with the city administration, the self-organised independent housing initiative (Selbstorganisierte Unabhängige Siedlungsinitiative, SUSI) was able to realise its alternative and coop-

erative co-housing project which, similarly to a student housing project, still occupies several of the former barracks. Together with the persistence of some mobile squatters, this contributed to the image of "the neighbourhood's aspects as tolerant and colourful" (Mössner, 2015b: 977) and provided for enthusiastic feeling of Christiania amongst early employees of the citizens' association Forum Vauban (Sperling, 2013). Here again, it becomes clear that sustainability transformations are not linear processes but rather contingent to a combination of local particularities, opportunities and arbitration between interests.

5.3 Retrofitting Freiburg's Building Stock

Since 1996, retrofitting the built environment is part of Freiburg's long-term climate action plan (*Klimaschutzkonzept*). Freiburg's city administration established a building management unit that centrally manages more than 450 city-owned or rented buildings (e.g. schools, school gymnasiums, child care facilities, city halls, community centres, administrative buildings, museums and fire station) (City of Freiburg 2011b). A main goal is to demonstrate leadership in realising the ambitious climate action plan. The main fields of actions are sourcing of certified green electricity, reduction of CO_2 emissions, usage of timber construction and other environmentally friendly materials and use of building components with environmental or fair-trade certification.

More challenging to govern though are retrofitting initiatives in the non-public building sector as there is no real leverage beyond financial incentives to encourage homeowners to adopt environmentally stricter building standards. Since 2002 Freiburg's local government supports private homeowners with the programme energy conscious retrofitting (Energiebewusst sanieren), which was initiated by the innovation fund of the regional energy supplier badenova AG. The city's environmental protection authority (Städtisches Umweltamt) has used this fund to provide financial support for thermal insulation retrofits, consultancy services (energy efficiency, cogeneration units), replacement of heating systems and energy management systems. By 2015, a total of 8676 grants for more than 10,000 units (dwellings or apartments) were awarded within this programme (Fig. 5.7). In addition, 11,667 units were renovated using credits granted by the federal government owned development bank KfW between 2009 and 2015 resulting in a total number of more than 20,000 retrofitted units. Nevertheless, there are still more than 60,000 not retrofitted buildings that were constructed before 1992.

The average annual retrofitting rate in Freiburg is 2% (number of retrofitted units in relation to the building stock) which is comparably high. Despite these high numbers of documented retrofits, the retrofit of the whole building stock will take decades as almost 60% of the buildings were built before 1992 when the stricter energy requirements had been initiated in Freiburg.

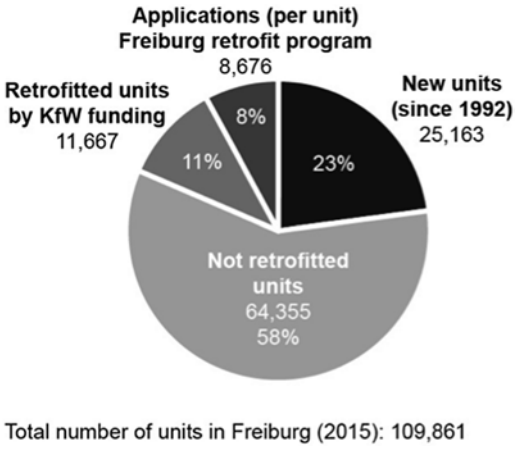


Fig. 5.7 Total number of built units in Freiburg (new and retrofitted) (Own figure based on GEWOS 2011; KfW 2009–2014)

5.3.1 The Weingarten District: Linking Energy-Efficient Retrofits and Social Sustainability?

An important retrofitting area in Freiburg is the urban renewal area Weingarten, a low-income district where more than 1500 mostly publicly funded residential units for almost 6000 people were created in the late 1960s. About 80% of these units were built for social housing purposes by the semipublic Freiburger Stadtbau GmbH (FSB), the largest housing company in the city. The FSB is the heir of a long tradition of municipal interventions in housing policy and building of social housing since the middle of the nineteenth century, which eventually became the Freiburger Stadtbau GmbH around 2000 (Klus 2013b). In 2006 the City Council unveiled their intent to privatise the Freiburger Stadtbau GmbH and accordingly the municipal social housing stock to address financial distress. Vivid discussions and debates followed amongst political parties and the public and eventually led to a local referendum on the subject. Following a very emotional and polarised campaign, the citizens refused the sale (see Klus (2013b) for a detailed account). This event revealed strongly contrasting views on the provision of affordable housing in Freiburg. The front lines persist until today and are an important background to any discussion going on in the city with regard to affordable housing (Klus 2013b: 182–184).

Three building types dominate in the Weingarten district: 16 storey high-rise buildings, eight storey buildings and four storey town houses (see Fig. 5.8). Despite initial renovation works in the 1980s, a retrofit of the entire building stock became necessary in the 1990s. Around 2000, most of the buildings had in addition fallen out of the rent control; a standard practice for social housing in Germany that controls rent increases for a certain number of years. As such the landlord (FSB) was entitled to increase the rents, but this proved quite problematic with the tenants, due to the poor physical conditions of the buildings. Finally in 2006, the first four storey buildings in the northwest of the urban renewal area were refurbished. This first step was essential before the retrofit of the first high-rise building Bugginger Straße 50,

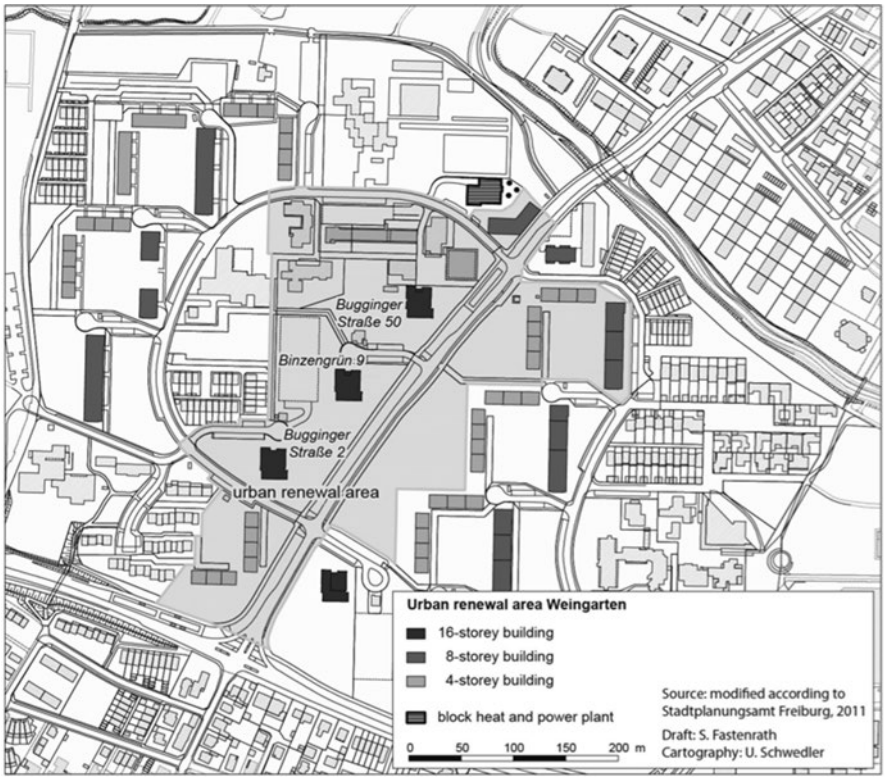


Fig. 5.8 The urban renewal area Freiburg Weingarten including Buggi 50 (Cartography: Ulrike Schwedler)

locally referred to as Buggi 50, could be initiated as tenants were offered to move to the renovated apartments during the construction time.

5.3.2 Buggi 50: From a Concrete Block to a Passive High-Rise Building

Between 2008 and 2010, the first of four 16-storey building blocks located in Bugginger Straße 50 (Buggi 50) underwent a fundamental facelift and turned into a green flagship project in Freiburg. The 40-year-old building was transformed into the world's first retrofitted residential high-rise building that meets the strict energy requirements of the passive house standard (City of Freiburg 2010a). The project has been characterised by a high level of technological innovation and experimentation and involved new stakeholder constellations including research institutes. The fact that the FSB is at the hands of the city plays here a key role through its intention to provide a lighthouse project with regard to the city's policy aims to increase

energy efficiency and to reduce CO_2 emissions. This is also reflected in the financial support of the project in Weingarten which required important funds covered by a mixture of public funding sources as outlined by respondents from the city (Frei12) and FSB (Frei01). Sources included the FSB, the City of Freiburg, but also federal and state government funds.

The whole area of Weingarten West had been earmarked since 2006 for the federal urban development programme Social City (Soziale Stadt) which provided a large share of the funding. In line with funding conditions of this program, which target socially disadvantaged areas, social aspects were implemented throughout the renewal of the Buggi 50 along the strong technological aspects. Triggered by committed employees of the Forum Weingarten 2000 e.V., an association in charge of community work in the neighbourhood, the retrofit involved input from social workers and tenants (Forum Weingarten 2017). Forum Weingarten 2000 e.V. significantly helped to communicate between the tenants and the landlord FSB. A resident survey conducted prior to the retrofitting process helped to identify relevant issues, suggestions for improvements, wishes and ideas. The resulting ideas for a community meeting room and a concierge who should provide increased security and act as a contact person were already taken into account in the planning phase. During *construction talks* (Baustellengespräche) organised in the course of the renovations, the residents were also able to provide further input, for example, regarding the building colour, single components in the new designed apartments and the community garden. After the finalisation of the building project, the social workers of the Forum Weingarten trained female residents as *thrifty spenders* (Sparfüchsinnen) to explain the usage of the building's new technological features to other residents. In addition, a couple of initiatives were started to strengthen social cohesion and reduce the anonymity in the large building. Events and contact persons promoting communication between the residents were established. Furthermore, residents have been brought together in a *floor swap* (Stockwerksbörse) before moving in to meet the potential floor neighbours and change apartments if necessary. While these initiatives are now part of the model character of the building, they have not been repeated to an equal extent in the following retrofits in Weingarten. Part of it is grounded with the usual shortcomings of participatory processes (including representativeness, time and financial costs, etc.). Despite these efforts, the landlord and the city seem to share the feeling that the community work with the tenants in Buggi 50 was not monitored and mediated enough, which led to tensions related to raised expectations and implementation possibilities (City representative, Frei12).

The main focus of the retrofit of Buggi 50 was to improve the energy efficiency performance of the high-rise building. Two elements played a key role to reach the passive house standard: an airtight building envelope and a ventilation system with heat recovery. To be able to achieve airtightness, the building design was improved in a first step. Thermal bridges were fixed, especially at the old balconies, and new shapes of the apartments were created. By reducing the floor area of some units, the total number of apartments increased from 90 to 138. Hereafter, highly effective insulation systems were installed at facades, roof and basement ceiling to guarantee airtightness. Innovative products such as 40-cm-thick thermal insulation, triple-

glazed windows and *Aerogel* insulation at the roller shutters box were used. A great challenge was the installation of a ventilation system that supplies the building with fresh air and removes stale air (Frei01, Frei07, Frei12). Due to the lack of comparable projects of this large building scale, the ventilation system needed a special design. As a solution, large industrial fans were installed on the roof. Besides the realisation of these technological features, a challenge was to comply with the strict fire protection regulations for air condition systems. A blower-door test proofed the airtightness of the building. The building's demand for heat decreased by almost 80% (from 68 to 15 kWh/m²*a) (Fraunhofer ISE 2013). The ISE monitored the retrofitting processes and analysed the energy consumption of selected apartments. A PV system with 25 kW peak power installed on the roof provides supportive electricity. The major source of power and heat is the natural gas-based cogeneration power plant which is located close to the building (see Fig. 5.8). The power plant operated by badenova AG, the regional electricity supplier, is connected to the districts Weingarten and Rieselfeld.

Debates came up in the context of costs and the potential exclusion of lower-income tenants due to the investments linked to the passive house standard. At the beginning of the renovation process, discussion focused on potential rent increases. Citizens and social organisations in particular criticised the process as "luxury renovation" (Representative of the energy agency, Frei05). A representative of Forum Weingarten explained the situation as follows:

> The tenants were interested in energy-efficiency. But there were also people in the house who said: No, we just want a minimal renovation, we want new windows and a decent heating system. Apart from that, it can remain as it is. Because there were immense concerns about the increased costs. For almost two years we discussed the rental rates again and again. The rental price is of course linked to the type of renovation and also the apartment size. (Frei06)

The FSB and owner of Buggi 50 indeed progressively increased the rents from 4.82€/m² to 6.67€/m² after the retrofit. The landlord argues that following smaller layouts and reduced energy costs, tenants pay roughly the same rent as they did before. While the rents remain under the Freiburg average of 7.35€/m² (City of Freiburg 2014b), this is still a significant increase considering that tenants comprise recipients of social benefits. In addition, the new agreement on rent controls is restricted to a 10-year period only and is hence soon bound to expire. In that light, it is worth mentioning that most of the former tenants did not move back into the renovated Buggi 50 building. Many stayed in other renovated apartments offered by the FSB. Interview partners explained this mainly through the demographic structure of former Buggi 50 tenants with a majority of elderly people not wanting to move twice within a short time period. Low return rates were also linked to technological scepticism. For example, some tenants feared that they would not be allowed to open the windows or to use the balconies following the renovations (Frei06). As former tenants were not interviewed, it is difficult to exclude the rent increase as an explanatory factor for original tenant's decision not to move back into the building.

Around four million Euros of the total project costs of 13.5 million Euros were invested in the improvement of the building's energy efficiency performance. A whole range of Freiburg-based experts evaluated Buggi 50 as an important flagship project but also criticised its high costs and questioned its status as a success model (Frei01, Frei06, Frei07, Frei15). Notably single elements of the building's retrofit have been questioned, especially the installation of the ventilation system which was necessary to achieve passive house standard. While the ventilation system provides a high level of comfort for the tenants, the installation but also the operation and the maintenance of the system are costly. Nevertheless, the standard was also copied to the other high-rise buildings in Weingarten. Similar technical principles were used for the Binzengrün 9 and Bugginger Straße 2 (Fig. 5.8). Based on the experience with the Buggi 50 project, the time of construction for the two later building retrofits was significantly shorter.

5.4 The Creation of an Urban Legend?

Freiburg looks back to a rich experience of targeted building projects and policies that mainstreamed sustainability aspects in the built environment, along a broader set of policies addressing sustainability in the city. Several elements displayed above strongly resonate with dimensions of Noel Longhurst's (2013) concept of an alternative milieu. Notably the framing of Freiburg's green distinctiveness as a result of activism and protest against a nearby nuclear power plant, the burgeoning and very dense network of civil society, newly created research centres, NGOs and businesses focused on questions of energy provision and the resulting pioneering solar building experiments in the 1970s and 1980s are all indicators of a very particular local milieu. Similarly, some of the distinctive experimentations around alternative ways of living in the Vauban neighbourhood including the relatively large number of building groups (Baugruppen) and cooperative projects like the SUSI are indicative of the alternative lifestyle dimension characteristic to Longhurst's analytical heuristic. Strong interactions with policy-making in the 1980s and 1990s have led to the development of, at the time, innovative and alternative environmental policies.

Slightly at odds with these alternative dimensions though is the city administration's current marketing slogan and corresponding documentation of best practice cases. *Freiburg Green City* claims that "Freiburg is regarded today as a model for the reconciliation of 'soft' ecology and 'hard' economics" (FWTM 2014: 2). The slogan has been used since the end of 2007 by the city administration and the local business, tourism and trade agency (Freiburg Wirtschaft, Touristik und Messe GmbH, FWTM) as strategy of interurban competitive positioning, following international requests on Freiburg's sustainability initiatives (Röderer 2007; Zimmermann 2008), in particular the eco-neighbourhoods of Vauban and Rieselfeld. Here, the sustainability dimension is clearly articulated with ecological modernisation elements by highlighting the strong local expertise of research centres and businesses

on renewable energy technologies, especially solar energy. The economic benefits of trade tourism aspects linked to Freiburg's environmental reputation complete the picture. The central role given to energy saving, carbon control and even carbon neutrality and as outlined in the city's climate protection strategy provides a consensual picture and socio-political fix (While et al. 2004; Lombardi et al. 2011; Long 2016). The arguments brought forward suggest indeed a neoliberal green growth rhetoric, seeing sustainability as an economic opportunity as well as improving quality of life (Dale et al. 2016). Other cities have applied similar strategies (see for instance Andersson 2016; McCann 2013; While et al. 2004) and have been criticised for perpetuating a socio-economic status-quo rather than offering truly transformational sustainability options.

In order to better apprehend the apparent contradiction between the narrated pioneering and activist beginnings of Freiburg's green building path in the 1980s and 1990s on the one hand, and the more recent Green City marketing agenda, on the other hand, it is worth taking a closer look at the rationales and justifications presented by the city administration in relation to its green building policies. This will allow to illuminate in how far this shift can be attributed to the gradual mainstreaming of green building initiatives through its uptake in the city's environmental policies from 1992 onward (Fastenrath and Braun 2016) and eventually, as has been argued elsewhere (Ray 2009), the subsuming of green aspects to rather consensual political goals like raising the attractiveness and profile of the city at an international scale or securing an economic strategy by supporting one of the city's key industries: the renewable (solar) energy sector.

The following analysis relies on City Council resolutions from 1994 to 2015 regarding the city's climate action plan (Klimaschutzkonzept) formally adopted in 1996 as well as the Green City Freiburg brochure (FWTM 2014). As buildings are identified as a key aspect to reach the city's climate change objectives, these documents have been favoured over the set of council resolutions dealing directly with energy efficiency policies in buildings which are significantly more technical in scope and thus offer less relevant material regarding underlying rationales. Based on the discursive analytical framework provided by Dryzek (2013; see also Sect. 4.3.4), two phases can be distinguished in the city administration's justification lines for green building. The first one starts in the early 1990s with the passing of the bill for low-energy standards in buildings as well as the genesis of the two eco-neighbourhoods, Rieselfeld and Vauban. The second phase started around the mid-2000s following increased international attention towards Freiburg successful environmental urban policies.

5.4.1 Pioneering Energy Efficiency in Building (1990 to Mid-2000s)

When Freiburg's energy bylaws were passed in 1992, they were ambitious and path-breaking, as they were significantly more stringent than the German federal regulations (Sect. 5.2). Despite its originality at the time, the approach of green building

Table 5.1 Pioneering energy efficiency in building: contextual meaning—making of green building in Freiburg (Categorisations after Dryzek 2013)

Pioneering energy efficiency in building			
Entities	Assumption about nature relationships	Agents and motives	Rhetorical devices
Global warming and climate change crisis	Management and rationalisation	Local level key to reaching sustainability	Crisis vocabulary
→Climate change = CO_2 and energy issues		Political responsibility in reducing CO_2 levels through energy efficiency	Quantitative analysis and targets (CO_2 levels, energy savings, etc.)
Responsible and decisive city administration		Heat insulation and renewables in buildings as priorities following technical and economic feasibility	Technical implementation issues and reporting (financial, practicality, controlling, etc.)
		Experts: exchange networks and research organisations (Öko-Institut, Fraunhofer ISE)	Administrative steering and rationalisation
		Cooperation with other actors impacting energy use (households, business, trade, industry, etc.)	

through energy efficiency shows many similarities to the present carbon calculus approach to green building as outlined in other case studies in this book (see for instance Chap. 6 on Vancouver and Chap. 8 on Luxembourg). The key rationale for acting on buildings revolves around global warming with a strong focus on the resulting looming crisis and dangerous consequences this will have at a global scale, including floods and droughts, the melting of the Arctic icecap, etc. (City of Freiburg 1994). Humanity's role in bringing forward this crisis through the consumption of fossil fuels leading to increases in CO_2 emissions is also particularly highlighted (Ibid; City of Freiburg 1996). As a result, climate change is here mainly apprehended through CO_2 emission and energy aspects and leads to a corresponding calculative, managing and controlling approach aimed at reducing energy consumption and hence emissions (Table 5.1).

Quantitative analysis and rhetoric are central to the argument, but they are also further constitutive of a display of the city as acting rationally on the basis of scientific knowledge and analytical reports provided by its strong collaboration with scientific institutes and experts (e.g. the Institute of Applied Ecology called Öko-Institut) as well as its involvement in international networks like the Climate Action Network or ICLEI. In that sense, the key responsibility of a city administration in general in addressing CO_2 emissions is particularly highlighted. Freiburg is taking an early and decisive but also political stand by leading on the crucial issue of climate change. Similarly, the international political climate change context and higher governmental level actions in climate change are only marginally evoked in favour of a more local or regional embeddedness.

Financial arguments are key from the outset involving a prioritisation of potential actions according to their CO_2 emission reduction potential, implementation effort but also financial sustainability of the communal budget. These ranking criteria have propelled heat insulation and energy-saving measures in existing and new buildings as well as the promotion of renewables to the top of the list (City of Freiburg 2007) to be implemented in cooperation with the energy consumers (e.g. households, firms, etc.). In sum, while legitimation is here articulated around the urgency of the climate crisis, the challenges are presented as manageable due to the pragmatic and steering approach of the city administration or as "a justification through recourse to techno-socially rationalised crisis discourses" (Caprotti 2014: 1290).

5.4.2 Freiburg, The Model Green City (Mid-2000s to Present)

In 2007, the city administration under the lead of its green mayor presented the Freiburg Green City slogan it had developed jointly with the FWTM. The concept was initially met by scepticism due to a rejection of Anglicism (BZ 2008), the feeling it was reductive and not original (Röderer 2008; Rüskamp 2008) and further grieves that the decision was unilateral and not transparent (BZ 2008; Rüskamp 2008). Nevertheless, the introduction of the slogan is symptomatic of an argumentative shift that can be further observed in the subsequent City Council resolutions addressing the follow-up of the climate action plan (Klimaschutzkonzept).

Instead of merely enacting the political responsibility of the city administration to act against climate change (Table 5.1), the "environmental excellence" (City of Freiburg 2008) of Freiburg's actions are brought to the forefront and have become a rationale per se. This shift can clearly be related to the perceived success of green building and environmental urban planning policies in the city's two flagship neighbourhood projects Rieselfeld and Vauban reflected in the international recognition and interest both projects have acquired (Röderer 2007). The City Council resolution setting the presentation of Vauban as best practice case at the 2010 World Expo in Shanghai exemplifies how benchmarking and comparison to other cities have become central to the rhetoric (see Table 5.2). The documents indeed emphasise that Freiburg will be represented along a list of 55 other cities from around the world including the detailed list in an annex (City of Freiburg 2008). In the same vein, the Green City brochure lists all the awards and prices Freiburg has received over the years.

The city feels compelled to stay ahead of the highly competitive city branding game by perpetuating its reputation and even pioneering character on sustainable urbanism (for similar examples on green branding in Växjö, Sweden, see Andersson 2016; for Vancouver, Canada, see Chap. 6 in this book as well as McCann 2013). A consequence has been to raise the climate protection concept to the next level by aiming to reach urban climate neutrality by 2050 with a bulk of the planned measures addressing again energy efficiency and renewables in buildings. As in the previous phase (Table 5.1), the city relies heavily on expert reports, as well as quantitative and financial analysis conveying anew a sense of sound and responsible management.

Table 5.2 Freiburg THE Green City. Contextual meaning—making of green building in Freiburg after 2000 (Categorisations after Dryzek 2013)

Freiburg *the* Green City			
Entities	Assumption about nature relationships	Agents and motives	Rhetorical devices
Green reputation and scientific expertise as economic advantages	Ecology and economy compatible: green growth and jobs axed around environmental (solar) technologies	The city has a responsibility as model and pioneer: always outperforming itself, be the first mover	The Wyhl-legend and proximity to nature (Black Forest)
Freiburg as a distinctive place: seedbed for the green party and civic traditions of environmental fight (Wyhl nuclear protest in the 1970s)	Social sustainability = quality of life/ green lifestyle	High implication of the FWTM (local economic development agency)	Moral rhetoric of political inclusiveness and participation and identification of inhabitants as strongly supportive and in favour
Post-carbon/carbon neutrality (study 2011) as the next level		Other governmental scales (national/ international) as enablers but not ambitious enough	Value-loaded vocabulary: innovative, future oriented, progressive city
		Business, research centres and university: green city cluster Freiburg	Comparison to other cities

The corresponding resolution (City of Freiburg 2011a) but also the related insert on climate neutrality in the Green City brochure are both sprinkled with a value-loaded vocabulary seeking to state the innovativeness and even boldness of the approach, successively qualified as “a vision”, “a climate (or energy) revolution”, “ambitious targets”, “exceptional measures, way over current climate change efforts”, etc. The substantial technological retrofit of the Buggi 50 high-rise building follows the same logic of displaying progressive and innovative green expertise not least following the involvement of experimental technologies and research centres like the Fraunhofer ISE in its completion.

This green branding is clearly indicative of an urban entrepreneurialism agenda (Andersson 2016; Long 2016; McCann 2013; While et al. 2004) that assumes the compatibility of the environmental and the economy agenda arising from growth potentials in environmental technologies and green reputation and expertise. In a top-down move similar to the set-up of the Eco-Innovation Cluster in Luxemburg (Chap. 8), the Green City Cluster initiative has been launched in 2009 by the FWTM in order to better coordinate and bundle the expertise of the large number of Freiburg located companies and research centres in the field of renewables, notably solar

energy, as well as touristic side effects to Freiburg's international reputation. The economic dimensions of Freiburg's green branding and marketisation strategies are already clearly stated in the 2008 council resolution concerned with the display of Vauban as best practice case at the Shanghai World Expo:

> Through Vauban's nomination at the exhibition, the FWTM […], in accordance with its business purpose, gets the unique chance to present the City of Freiburg in one of the world's strongest economic regions over a period of six months. Due to the direct thematic closeness to the World Expo slogan 'Better City – Better Life', it will be possible to point out the excellence of environment related topics in Freiburg. This will lead to a sustainable promotion of Freiburg's firms and service providers, the university and the research centres, especially in the environmental economic sector. In addition, the opportunity to present [Vauban] offers an outstanding chance for place promotion, for a positive development of the economy, science and research. Also tourism, especially technical, congress and trade fair related tourism for Freiburg will be significantly improved through the presentation. (City of Freiburg 2008)

Interestingly though, the city's self-representation of its model green character relies heavily on narrative references to the specific history and context of the strong environmental consciousness of the civil society and the opposition to the Wyhl nuclear plant. Freiburg is presented as "the birthplace of the environmental movement", while "milestones" of Freiburg's "green profile" are displayed in a timeline starting with the resistance to Wyhl in 1973 (FWTM 2014) which gains the status of a foundational myth central to Freiburg's identity as Green City. This is complemented by conveying the sense that Freiburg's environmental sensitivity spurs from the strong connection to the seemingly pristine natural surroundings of the Black Forest, in an utopian and aesthetic spatial imaginary in line to what Longhurst (2015) observed in Totnes. This is where the observed alternative experimentations in line with Longhurst's (2013) alternative milieu meet with the apparently contradictory green growth rhetoric and justifications of the city administration to provide a coherent storyline (Andersson 2016) around a sustainability policy fix (While et al. 2004) that ultimately seeks to secure support of the socio-economic status quo, despite claims of green innovativeness.

Mössner (2015a, b) and Kronsell (2013) have already thematised this politically instrumentalised process at work in Freiburg, which consists in the reappropriation of the moral elements of political inclusiveness and tolerance conveyed by the activist dimensions. The ultimate aim is to reach internal consensus, to legitimate and secure the green growth ambitions at stake in the Green City project that translate into a morally compelling and hence undebated or apolitical project (Mössner 2015a). The reappropriation further contributes to an identity buoying by the citizens, which Andersson claims for Växjö, relies on a sense of pride for their city's green distinctiveness "and can also ensure the continuity of green policies [through citizen] support" (Andersson 2016: 1210).

The fact that most of these alternatives were mainly initiated by active citizens and nowadays are regarded as exemplar (e.g. the large share of cooperatives and house building groups in Vauban or the large number of incidental passive houses

that were initially opposed by the city's administration (Späth and Rohracher 2015)) is here conveniently bypassed. Similarly, socially problematic aspects, like the continuous challenges in housing accessibility and affordability (Klus 2013b) or the social self-selectivity (Hamiduddin 2015) and social homogeneity of Vauban (Freytag et al. 2014), are mainly left aside in the narrative. Nevertheless, there is growing awareness amongst stakeholders that Freiburg will have to take a stronger hold on the social dimensions of sustainability in order to defend its leadership status (BZ 2008; Bochtler 2012).

5.5 Conclusion

The globally recognised case study Freiburg gives the opportunity to trace long-term sociotechnical transitions in the building sector. Freiburg, often reviewed as best practice in urban sustainable development, has a long tradition of addressing sustainability in the built environment. The starting point of urban green building transitions can be traced back to the 1970s when bottom-up processes were initiated and mainly driven by pioneers, early adopters, research institutions and engaged citizens. Local niche experimentation, learning processes and knowledge production were crucial for changes in building practices and interactions with policy-makers. As a result of continual interactions and bargaining between niche actors, agents and policy-makers, policy initiatives supporting energy efficiency in the built environment were introduced in the early 1990s. City own low-energy requirements were introduced and emended with the development of the two eco-districts Rieselfeld and Vauban which still receive global attention as best practice. This has been complemented since the mid-2000s by the rise on the agenda of the issue of retrofitting and the introduction of financial incentives.

What can be regarded as a successful policy development has been increasingly accompanied by a raising marketisation at an international level of Freiburg as a Green City. In what can be regarded as an urban entrepreneurial project, Freiburg's past achievements have been harnessed in a compelling story that reveals a convergence with economic development objectives (e.g. international branding, development of a green economy sector) as well as ensuring buy-in and the political support of citizens. But further than calling for a critical reflection of the selective assumptions behind this shift, it is worth raising the question of its impact on green urban policies that, at least at some point, were path-breaking and innovative. In her work on Green City branding practices in Växjö, Andersson (2016) pointedly raises the issue of resulting policy path dependencies, notably in terms of less flexible green policy definitions, earmarking of public funding and the promotion of flagship projects. This in turn and quite ironically might be detrimental to precluding new and alternative sustainability policies as Freiburg seems to rest on its laurels.

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Chapter 6
Vancouver: Leading Green Building Transitions?

Kirstie O'Neill and Julia Affolderbach

Abstract Vancouver has been widely promoted and recognised as a green city, as reflected in a number of awards and international rankings. This chapter analyses the trajectory of greening with specific reference to green building in Vancouver. It identifies three examples of green building: (1) the University of British Columbia as birthplace of more radical thinking in terms of sustainability, (2) the Olympic Village in Southeast False Creek as green model neighbourhood and (3) Vancouver's Greenest City 2020 Action Plan as policy strategy to promote green building. Based on these three examples, the chapter highlights the interplay of local and global influences on green building transitions and critically investigates the impacts of these on the city. Reduced carbon emissions and improved quality of life are central to green building transitions in Vancouver, but neoliberal and entrepreneurial objectives together with a shift towards quantified approaches of greening are challenging the former. While leadership is omnipresent in representations and narratives of Vancouver as a green city, greening strategies largely fall into what is commonly considered as incremental and predictable, rather than radical change, thus adding a question mark to leadership claims.

6.1 Introduction

In this chapter we explore the ways that green building has been adopted and adapted in the metropolitan region of Greater Vancouver, British Columbia, Canada (Fig. 6.1). Within the agglomeration of Vancouver, and in particular the City of Vancouver, specific institutional actors, such as the City Council, the University of British Columbia, the Canada Green Building Council and other NGOs as well as the broader community of green building practitioners, have implemented green building as a means of both meeting climate change targets and in situating the city as a global leader in green building practices specifically and green practices more broadly. Green building endeavours in Vancouver have been framed as innovative

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Fig. 6.1 Downtown Vancouver as seen from Queen Elizabeth Park (Photo: Julia Affolderbach)

and experimental, driven by a purportedly high degree of environmental consciousness and responsibility but also by an ambition to break new ground. This chapter explores in particular the role that leadership in green building has played in locating the city and region as a global key player in policy and practice on urban sustainability. It does so by critically analysing the origins of innovation and change and their relevance at various spatial scales. The chapter introduces the Vancouver region and the political and economic context which frame how green building evolved in the city, before moving to the empirical material gathered through an expert workshop and 34 interviews with key actors in the green building sphere.

6.2 Trajectories of Greening

The urban agglomeration of Vancouver is located on the west coast of Canada, framed by the Pacific Ocean to the west, the Coast Mountain range to the north and the US border to the south. Vancouver is frequently seen as being strongly influenced by the natural beauty that surrounds it and which arguably evokes a strong sense of environmental consciousness and obligation amongst its population. Vancouver has been described as "a vast display case for the aesthetic consumption of nature" (Berelowitz 2005: 162). As the birthplace of Greenpeace and the David Suzuki Foundation founded by Vancouver-born David Suzuki, Vancouver has been

a centre of early environmentalism and sustainability. There is a strong narrative that places Vancouver as a metropolitan region, specifically, and to some extent, British Columbia (BC) as a region, as being dominated by a *deep green* alternative political climate. While there are certainly elements that do embody these ideals, there are inherent contradictions that need to be recognised when discussing the sustainability politics of this province and city. These contradictions are more regularly identified at the federal level, where the *brown* politics of the geographically distant political centre in Ottawa that promotes a resource- and energy-intensive growth agenda (Scerri and Holden 2014) stands in contrast with the sustainability and greening initiatives in (parts of) BC. It is less often noted that BC, despite its sustainability advances, is, at core, a predominantly extraction-based economy, with forestry, natural gas and mining being core components. Contrary to many accounts, this suggests a more fragmented image locally, as being green clashes with more problematic images associated with 'dirty' industries. With the election of Justin Trudeau (Liberal Party) as Canada's prime minister in 2015, federal politics show some signs of change. For example, one year after his election, Trudeau announced the introduction of a tax on carbon emissions for 2018 (Associated Press in Toronto 2016). At the same time, the government has also demonstrated continued interest in large-scale resource extraction giving a conditional approval for a major energy project, the Northwest Liquefied Natural Gas project, which calls Canada's commitment to fight climate change into question.

In comparison, the province of BC was one of the first governments to implement a revenue neutral carbon tax applicable to everyone consuming fossil fuels in the province. The initial tax rate was relatively low but has been gradually increased from 2.41 cents per litre in 2008 to 6.67 cents per litre on gasoline in 2012[1] to encourage producers and consumers to reduce their emissions. These green influences are captured in prevalent sustainability narratives of Vancouver that revolve around the strong links between nature and residents. These narratives are frequently presented in the secondary literature on Vancouver and also emerged during the expert workshop and personal interviews conducted. For example, in his review of greening in Vancouver, James Glave (2006) claimed that being "home of David Suzuki, Cornelia Oberlander, Terry Glavin and a long line of world-renowned shit-disturbers, our city boasts more eco-cred than George Clooney, Julia Roberts, and all their Prius-piloting pals put together". Similarly, respondents frequently related local identity and culture to early environmentalism and a number of thought leaders: "Vancouver was the home starting point of Greenpeace and a number of other environmental initiatives, so there is kind of a local culture around that" (Infrastructure expert at UBC, Van15). This pervasive discourse of Vancouver's green image has been reproduced, established and shared over the past decades.

Vancouver is the biggest urban agglomeration in BC with approximately 2.5 million inhabitants. The metropolitan agglomeration of Greater Vancouver (in the following referred to as Vancouver) is governed by Metro Vancouver, a political body representing 24 local authorities including the City of Vancouver with a population of 600,000 residents (Fig. 6.2). While Metro Vancouver provides services across

[1] Rates for diesel and jet fuel lie above, natural gas and propane below the gasoline tax rate.

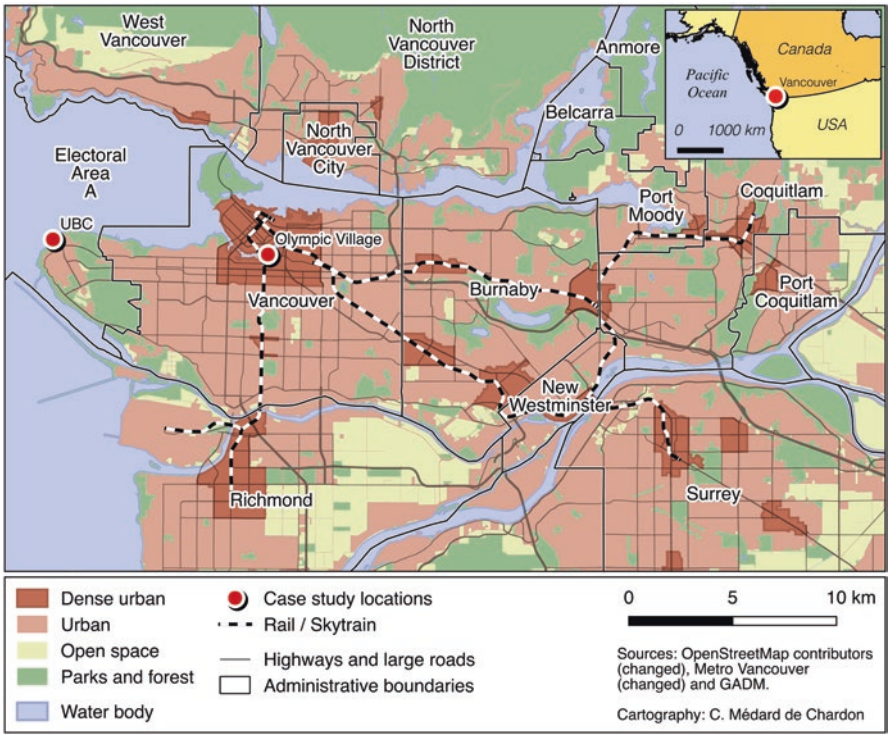

Fig. 6.2 Map of Metro Vancouver (Cartography: Cyrille Médard de Chardon)

municipalities (e.g. transportation, water) and blurs the lines between individual municipalities, it is important to highlight that commitment to sustainable development and green leadership varies considerably within the organisations that together make up Metro Vancouver. Two municipalities frequently seen as green leaders within Metro Vancouver are the City of Vancouver and the University of British Columbia (UBC), which is located within the University Endowment Lands on the Point Grey peninsula (Fig. 6.2). The City of Vancouver holds a unique position through the Vancouver Charter that grants the city and its mayor greater independence and regulatory authority than other municipalities under provincial legislation. Further, the city has shown an early political interest in climate change mitigation (see Sect. 6.3).

While Vancouver is frequently listed amongst the top cities in global liveability rankings, the constraints of the natural setting (the mountain range and coastline) also restrict urban development and pose a number of challenges. More recently, the City of Vancouver was featured in studies of the most unaffordable cities where it ranked third after Hong Kong and Sydney (Osborne 2015; Financial Post 2016), and the Swiss bank USB ranked it first before London in the Bubble Index that measures overvalued property markets (Brignall 2016). Problematically, the region is expected to grow by 30,000 new residents per year to a population of 3.2 million by 2040 (Metro Vancouver 2014) but is already experiencing a shortage in housing with low

rates of vacant units (below 1%) and high prices for real estate in the area. With no indication of housing prices stabilising in the near future, population pressures together with increased costs of living aggravate pressures to provide sufficient and affordable housing not only for low-income groups but increasingly also the middle class (Peck et al. 2014; Rosol 2015b). Inequalities within the population are expected to increase as the region already shows one of the greatest disparities between medium income and housing costs in Canada (City of Richmond representative, Van04). Accordingly, criticism of the City's sustainability strategies in particular in respect to social sustainability has amplified. The emergence of green building in Vancouver has, in the view of many, aggravated inequalities with a tendency for high-cost "Lexus rather than Fords" type green buildings (Green building expert, Van08). As housing and rental prices continue to rise, liveability becomes harder to achieve.

While strong climate change objectives have undoubtedly shaped the development of green building in Vancouver, growth and affordability pressures have also been important and are expressed through a range of green building innovations. The area is characterised by relatively low urban density, particularly in suburban residential areas, and is geographically limited by the coastline and mountains. The growth strategies over the past 20 years consisted largely of infill, and intensification of urban areas is also reflected in current strategies foreseeing an increase in population density from 33.3 to 44 persons/ha (Metro Vancouver 2014). More recently, implementation of the densification policy has extended along the major transit corridors in particular around SkyTrain stations. Furthermore, the City of Vancouver is well known for its urban planning concept, widely referred to as Vancouverism, which focuses on densification in the central city, paired with the creation of highly desirable public urban spaces to increase inner city living and repopulate the urban centre with all demographic groups (Berelowitz 2005). In particular, it seeks to re-attract families from the suburbs back to the centre which tends to be dominated by empty-nesters (Kear 2007). To some extent, this liveable downtown core can be traced to the campaign spearheaded by The Electors' Action Movement (TEAM) in the early 1970s, to prevent a superhighway being constructed through the downtown of Vancouver (see Lees and Demeritt 1998: for a discussion). While urban densification is a commonly adopted planning objective in North America (and elsewhere), the City of Vancouver was one of the first to employ the concept in creating a liveable urban core. Urban planning and design have played a significant role not only in densifying the urban region but also in support of sustainability and greening endeavours more generally.

Vancouver features a number of widely publicised, innovative green building projects. UBC (Fig. 6.3) started to develop its first experimental green buildings in the early 1990s with its award-winning C.K. Choi building. More recently, the Olympic Village in Southeast False Creek (Fig. 6.3) was awarded Leadership in Energy and Environmental Design (LEED) platinum certification for Neighbourhood Developments in 2010 and the VanDusen Botanical Garden Visitor Centre, which opened in 2011, has been registered for Living Building Challenge status (Table 6.1). These are examples that have received considerable attention beyond the region. According to a study on green building in BC conducted by the Pembina Institute (2015), the sector has grown recently and the trend is expected to continue into the

Fig. 6.3 The City of Vancouver with the case study locations of the Olympic Village in Southeast False Creek and the University of British Columbia (Cartography: Ulrike Schwedler)

future. That study identified 8900 green homes rated at or above EnerGuide 80, and 1105 large green buildings, which meet a number of green certification standards (including BOMA BEST, Green Globes, LEED, Passive House, Living Building Challenge; see Table 6.1) in the province, with the majority of the latter being located within Metro Vancouver, in particular downtown Vancouver. The launch of, and increase in, certification schemes was viewed by many respondents as crucial in promoting and establishing an understanding of green building. However, more recently, certification schemes have been also criticised by some building experts as restricting further experimentation and being open to misinterpretations by the public in particular given the increase in the number of schemes (see Sect. 6.6). The proliferation of green building certification schemes, and the promotion of a particular notion of what green building constitutes, is seen as problematic by some (Boschmann and Gabriel 2013; Gibbs and O'Neill 2015). The green building sector is currently estimated to contribute over 23,000 jobs directly and indirectly to the province's economy including 34 manufacturer and supplier firms in green building (Pembina Institute 2015).

Table 6.1 Green building certification schemes in Canada, the United States, Europe and Australia (Source: Renner (2016) and own research)

Name	Year	Spatial scale	Focus	Developing/ administering organisation
BREEAM (Building Research Establishment Environmental Assessment Methodology)	1990	United Kingdom, Europe, others	All buildings and stages incl. whole life cycle	Building Research Establishment Global
Passive House	1996	Germany, Austria, others	Energy efficiency	Passivhaus Institut
LEED (Leadership in Energy and Environmental Design)	1998	United States, Canada (and 150 other countries)	New buildings	US Green Building Council
One Planet Living	2003	United Kingdom, others	Holistic approach based on ecological and carbon footprinting	Bioregional
Green Star	2003	Australia, New Zealand		Green Building Council Australia
Green Globes	2004	United States	Commercial buildings	Green Building Initiative
BOMA BEST (Building Environmental Standards)	2005	Canada, adapted for the United States by the Green Building Initiative	Existing buildings	ECD Energy and Environment Canada administered by the Building Owners and Management Association (BOMA)
Living Building Challenge	2006	Cascadia (United States and Canada)	Holistic approach based on ecological and carbon footprinting	International Living Future Institute
REAP (Residential Environmental Assessment Program)	2006 (full version)	UBC neighbourhoods only	New buildings	University of British Columbia
DGNB (German Sustainable Building Council)	2008	Germany, Switzerland and other European countries	New buildings incl. neighbourhoods and industrial sites, since 2016 existing buildings	German Sustainable Building Council
HQE (High Quality Environmental Standard)	2009	France, others	New buildings	HQE Association (Association pour la Haute Qualité Environnementale)

6.3 Emulative and Competitive Green Leadership

Many of Vancouver's greening initiatives have focused on urban sustainability, targeting environmental and social aspects through public and non-government policies and initiatives that can be traced back to the 1980s and 1990s. This section focuses on the role of leadership and spatial dimensions that shape green building in Vancouver, and in particular more recent transitions towards climate change governance and carbon management. These are interpreted as emulative and competitive green leadership and illustrated by three case studies introduced in the following (Sects. 6.4–6.6).

Urban sustainability in Vancouver is strongly linked to urban planning and design. The ambition to turn Vancouver's downtown into a liveable space for residents in the 1980s promoted the mixed-use and public-space-oriented urban development ideals known as Vancouverism. The 1990s marked a shift from general sustainability debates towards specific initiatives on climate change action and carbon governance (Fig. 6.4). The Clouds of Change report published in 1990 is the first document calling for climate change action at the local scale, marking a transition towards climate change mitigation as a local problem. The City Plan adopted in 1995 provided direction to local organisations in developing sustainable communities (Rosol 2015a; Punter 2003). The mid- to late 1990s saw the development of a comprehensive transportation plan that emphasised public transit, cycling and walking. In 2002, the Cool Vancouver Task Force was established to draft action plans to address climate change that translated into plans, targets and strategies for greenhouse gas reductions at the local scale. Public participation and citizen engagement has been a strong component of Vancouver's sustainability strategies. According to a number of studies, Vancouverites are far more likely to reduce their individual carbon footprint than residents from other cities in Canada and the United States (Glave 2006), although this may be limited to specific aspects of life, while other practices are more resistant to change (especially given the low price of hydroelectric energy in the province).

Former Vancouver mayor Sam Sullivan (2005–2008) launched the EcoDensity initiative in June 2006 (passed by Council in 2008) as an attempt to achieve sustainability, affordability and liveability by means of "high quality densification" (City of Vancouver 2006: 4) especially in low- and middle-density parts of the City of Vancouver (Rosol 2013). Amongst a wide range of aims, the EcoDensity initiative was primarily aimed at tackling issues that are seen as endemic and problematic in Vancouver: housing affordability, housing choice, urban sprawl, traffic congestion and loss of agricultural land to development. The ambitious initiative also targeted Vancouver's ecological footprint and was viewed as a means of retaining Vancouver's position in quality of life league tables. This leadership and a focus on such metrics that place Vancouver in liveability and quality of life league tables can be seen as tackling those endemic issues while potentially contributing to their exacerbation. The campaign was largely criticised due to both the political sensitivity regarding its developer-driven agenda and public unpopularity of the idea of urban densification

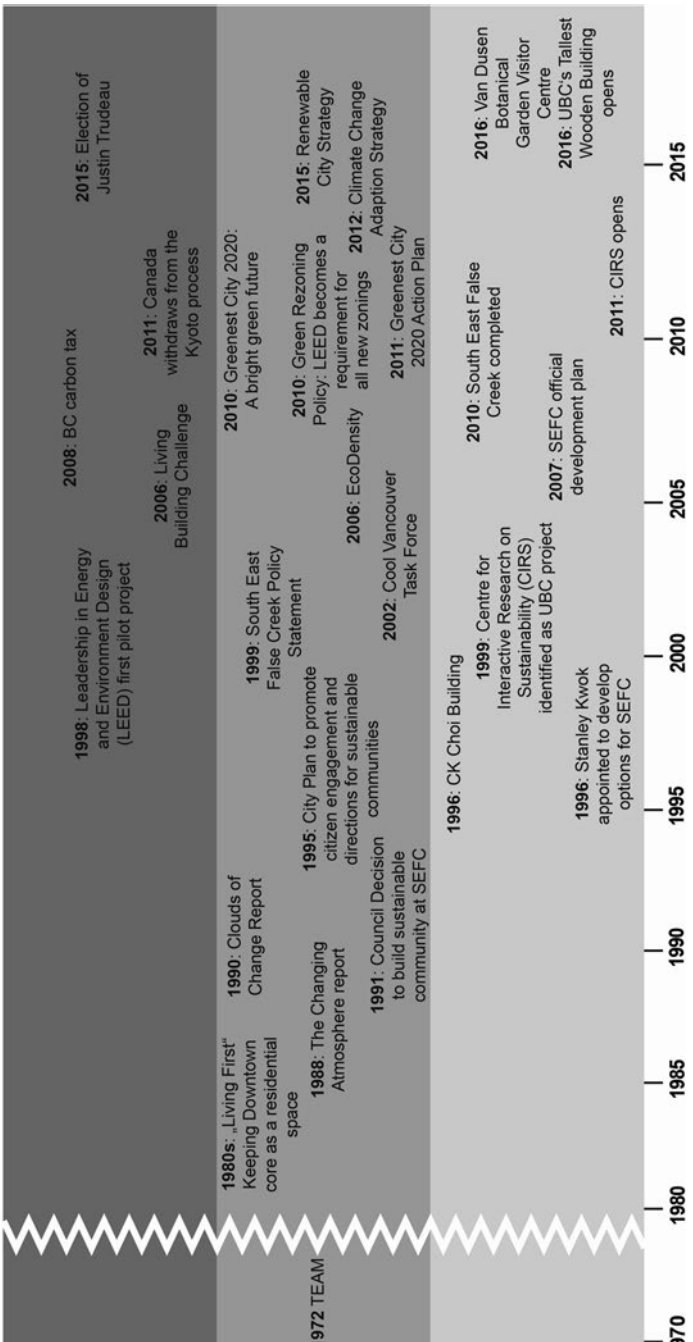

Fig. 6.4 Milestones and events in urban sustainability in Vancouver (Illustration: Ulrike Schwedler)

(Rosol 2013). In 2011, the introduction of the Greenest City 2020 Action Plan (GCAP) manifested the adoption of a target-based league table-oriented approach in Vancouver's sustainability efforts and sought to establish the rank of Vancouver as global green leader, with the objective of being the "greenest city in the world by 2020" (see Sect. 6.6 below, as well as Affolderbach and Schulz 2017). The City of Vancouver's ambitious plans have indeed received global recognition through international awards such as the 2015 C40 Cities Awards for Carbon Measurement and Planning, but are not uncontested. For a critical analysis of this form of carbon control and ecostate restructuring see, for example, While et al. (2010).

The 1990s also saw the emergence of green building as part of climate change governance (Chap. 3). While greening initiatives in Vancouver draw strongly on the close links between nature and residents, often described as West Coast spirit, greening initiatives were also strongly influenced by individuals and a range of extra-local factors from the provincial to the global scale. Green building started to emerge in the mid- to late 1990s with a focus on energy efficiency and reduction in resource use where cost savings were used as a general entry point that over the years shifted to more integrated building design. For example, the mid-1990s presented the industry with innovative guides (Green building expert, Van05) on how to make better choices in respect to the reclaiming of building materials and reuse in buildings emphasising material recycling, reuse and waste. Green building practices in Canada started to become institutionalised primarily through the LEED certification programmes. The Canada Green Building Council (CAGBC) was established during the same period. The first version of LEED that was developed in the late 1990s (with a pilot version in 1998) provided a first common vocabulary and language to describe green building, as confirmed by a number of green building experts (Van03, Van05, Van08). LEED version 2 that came out in the mid-2000s manifested a common language, criteria and definitions of green building that slowly turned green building into a marketable concept. "LEED allowed the mainstream [population] to understand, in very simple terms, that a Gold building is better than a Silver building" (Green building expert, Van03). In the 2000s, green building standards and requirements became enshrined into building bylaws and other policies at the municipal level, such as the 2014 Vancouver Building Bylaw 10908. This ability to create such bylaws is unique to the City of Vancouver, and according to them, it has enabled the city to be a "leader with respect to building regulations" (City of Vancouver 2014).

Green building innovations in Vancouver are driven not only by a strong public commitment to sustainability but by a number of mainly local key individuals. At the local level, these include leading scientists, practitioners and visionaries who have acted as thought leaders (or "policy entrepreneurs" (cf. Kingdon 1997) who promote particular ideas and framings of solutions to given problems, such as energy consumption) and who have largely shaped the work of urban designers, architects and engineers in Vancouver and beyond.

> The early adopters of LEED were here in Vancouver, the people that drove LEED Canada, the CAGBC, were largely Vancouverites, and some of the early projects were here in

> Vancouver, and you had kind of maverick developers like Joe Van Belleghem[2] (Green building expert, Van03).

The C.K. Choi building (Sect. 6.4) and the planning of what is now known as the Olympic Village (Sect. 6.5) are earlier examples of green building experiments and stand for green visioning made in Vancouver. Central actors directly involved in these developments such as Freda Pagani, UBC's first sustainability officer, were frequently identified as key figures. Respondents argued that architects, urban designers, planners, engineers and other professionals often act(ed) as role models and engage(d) in experimentation sharing knowledge with their peers and communities within Vancouver but also across Canada. Many other names were frequently dropped in conversations and interviews on green building including Bob Berkebile, Larry Beasley, Bill Reed and Peter Busby, founder of the Sustainable Design Initiative and the CAGBC, who is associated with establishing green building in Vancouver. The close-knit network of green building pioneers suggests a close relationship between research, academia and practitioners in establishing green building in the region. Political leaders, most recently Mayor Gregor Robertson of the City of Vancouver, have been similarly influential in initiating a number of greening strategies and in extending the reach of these beyond British Columbia. For instance, Mayor Gregor Robertson is a board member of the Global Covenant of Mayors, which also offers a platform to promote Vancouver's green credentials.[3]

While emphasis is placed on the local scale, green building innovations are also always products from elsewhere and can be understood as assemblages (McCann and Ward 2012a). Key actors emphasised sources of inspiration from around the world, particularly Europe, and key events of transnational magnitude but also incidents that connect and blend the local with other places and scales. At the same time, best practices and success stories (but also failed attempts) provide inspiration and drive Vancouver's ambition. Even though the rhetoric used presents Vancouver as global leader—particularly in respect to the City of Vancouver's most recent greening strategies—comparison and competition seem much more focused on North America where the broader context of green building (and energy consumption) tends to be similar (e.g. low-density residential suburbs in North America versus dense urban structures in Europe) as discussed in more detail below. While the West Coast spirit was frequently identified as a major driver of environmental change, the environmental endowment of the region also provides challenges. Barriers to green building in Vancouver relate in part to environmental factors such as its temperate climate and relatively high resource endowment. The availability of comparatively cheap (hydro) power and the associated low-energy costs obviate the need for consumers to reduce their energy consumption (City of Richmond representative, Van04).

In summary, Vancouver has shown early initiative to respond to climate change. It has undergone a transition from a predominant focus on energy in the 1990s and

[2] Who developed the Dockside Green Project in Victoria, B.C.

[3] http://www.globalcovenantofmayors.org/about/board/ (accessed 5 July 2017).

on sustainability and green building through LEED and other certification programmes in the 2000s (still emphasising energy) to a newly emerging concern around human health, well-being and liveability (e.g. healthy buildings, healthy materials, healthy public spaces) in the 2010s as well as aspects of regenerative building design that focus on the positive impact buildings can have on their environment. While Vancouver has responded to climate change comparatively early, a number of the actions are relatively predictable, and most of the initiatives constitute neoliberal approaches to urban development that rely on incremental rather than more radical and substantial conceptions of change. The following sections focus on three case studies of green building and urban green leadership including the UBC using an institutional perspective, the Olympic Village as neighbourhood development and the GCAP in respect to policy innovation.

6.4 The University of British Columbia

UBC has been a longstanding and central institution in driving an ethos of green building in Vancouver and beyond, both through its academic programmes and its green campus. As hubs of knowledge and learning within cities, universities are well positioned to act as initiators and test beds of sustainability initiatives and, as such, link research knowledge with implementation and real-life urban practice. This subsection will focus primarily on the latter discussing campus developments and exchanges between other knowledge communities. UBC counts about 50,000 students, staff, faculty and residents. UBC as independent entity manages its 1000-acre campus.[4] The campus area includes a number of residential neighbourhoods for a population of about 10,000 people. UBC's residential neighbourhoods were developed under 99-year prepaid leases to development companies to generate revenues for the UBC endowment and are managed separately from UBC through the University Neighbourhoods Association.

Sustainability as a central theme emerged at UBC on the operational side during the late 1980s and early 1990s through a number of green building experiments that tested alternative building materials, innovative passive design and sustainable solutions such as passive cooling and recycled materials. The C.K. Choi building opened in 1996 and was frequently named by respondents as having pushed the boundaries of sustainable building at the time (UBC representatives, Van15, Van18). Around the same time, academics were placing sustainability onto the research and teaching agenda, for example, researchers William Rees and Mathis Wackernagel with their ecological footprint concept. In 1997, UBC adopted its first sustainable development policy and a year later established the Campus Sustainability Office. Over the years, research, course work and programmes were increasingly being built around sustainability and green building, highlighted more recently by the Centre for

[4] The University Endowment Lands adjacent to the UBC campus are managed by the provincial government and are not part of the university.

Interactive Research on Sustainability (CIRS), which opened in 2011. Sustainability was inscribed into UBC's strategic plan through its sustainability goal to turn the university into "a living laboratory in environmental and social sustainability by integrating research, learning, operations, and industrial and community partners" and more specifically by making UBC an agent of change (University of British Columbia 2012). The UBC Sustainability Initiative (USI) was started in 2010 to facilitate cooperation between the previously separate work on the academic and operational sides under Professor John Robinson, the first USI director. Green building is also a central part of UBC's Climate Change Action Plan.

The sustainability focus at UBC needs to be seen within global trends of sustainability transitions driven by government institutions more generally and the university sector more specifically (Robinson et al. 2013). Universities are frequently seen as drivers of change and are understood simultaneously as incubators, living laboratories and niches for green transitions (König 2013; Evans and Karvonen 2011). As hubs of knowledge and learning within cities, universities are seen as being well positioned to act as initiators and test beds of sustainability initiatives and, as such, link research knowledge with implementation, teaching and real-life urban practice. Universities often own the land and buildings they occupy and operate their own energy, water and waste systems (Robinson et al. 2013). Some respondents argued that universities as public institutions were more commonly expected to take risks and show leadership compared to private sector institutions. While universities have the same financial pressures as other businesses, they may be willing to accept longer payback periods. While the strong interest in sustainability at UBC has also been linked to the policy context at the provincial level and Vancouver's alternative milieu including the so-called West Coast spirit that has embraced sustainability to a significant extent, respondents also highlighted a UBC-specific culture that "provides opportunity for experimenting and trying different things" (UBC representative, Van15). At the local scale, the rise of sustainability at UBC has been primarily linked to individuals who were commonly identified as "champions for driving and promoting change […], individuals who were both in the administration and in the faculties and who were interested in driving change around sustainability" (UBC representative, Van15).

Early leaders in green building were associated with the operational side and the establishment of the Sustainability Office in 1998. Freda Pagani, founder and director of the Sustainability Office at UBC, was a key figure behind developing green building guidelines, energy efficiency strategies as well as the creation of the C.K. Choi Building, UBC's first ecologically friendly building (Fig. 6.5). Pagani (2014, Van02) recalled how she herself had been greatly inspired by Rees' work and specifically a talk she attended that motivated her to change the way she approached her work at UBC where she was in charge of new building projects including the C.K. Choi building, which is the home of the Institute of Asian Research and the Institute of European Studies. Following discussions with UBC management, Pagani was given permission to include innovative green building design as long as the new development stayed within the given budget and timeline. The building was designed with four targets in mind: reducing consumption and environmental

Fig. 6.5 The C.K. Choi building, UBC's first green building (Photo: Julia Affolderbach)

impact, low-energy and pollution of building materials used, low-energy demand in operation and creation of a liveable work space (Will 1996). Green building features include composting toilets, 50% recycled material, maximisation of daylight use and natural shading and ventilation, which was helped by the building's narrow design. The creation of the Sustainability Office was seen as crucial, providing a framework for building design guidelines, energy performances targets and changes over time. Challenges in the early years consisted of financial constraints as well as limited interest amongst university staff and faculty. Rather than providing a fixed budget, the office was to be financed through the savings that were gained from green retrofits and improvements in energy performance of new buildings. Pagani recalled during an interview how she was "all that winter praying for good weather, praying it didn't get cold" in order to stay within a working budget (Van02). Another early struggle mentioned was to get academics involved in green building projects, pointing to tensions between academics as role models and thought leaders who were being expected to attract grant money and big projects rather than becoming actively involved in campus projects. This is a challenge that has gone some way to being resolved more recently, with academics becoming increasingly involved in sustainability initiatives.

Some respondents emphasised how UBC's reputation in green building has been largely shaped by the work done on the operational side including early experimentations such as the C.K. Choi building that helped establish UBC's image as a sus-

Fig. 6.6 The Centre for Interactive Research on Sustainability, UBC (Photo: Julia Affolderbach)

tainable campus. From a university management perspective, investment and support for sustainability and green building are strategic. Sustainability and green building can contribute significantly to a university's competitive advantage helping to attract research funding, increasing the reputation for students and researchers and translating into financial returns. "There is a business case for sure. And we do think about that" (UBC representative, Van15). For example, one green building expert argued that the CIRS building could be seen as core to UBC's identity having received financial priority under President Toope:

> CIRS has become part of UBC's brand identity, and CIRS was able to create new forces. It created new programmes for students out there, that are based around research relevant to the building, and it's the first time I've seen a building become a catalyst for change. (Van03)

The importance of green buildings is also highlighted by the promotion of green building through a range of free green building tours available to visitors. Tours focus on specific buildings such as the C.K. Choi and CIRS building and the Bioenergy Research and Demonstration Facility and are led by student volunteers. The CIRS building (Fig. 6.6) has offices for most of the green leadership at UBC and has been described as political think tank in respect to greening and sustainability. CIRS was initiated by Professor John Robinson in 1999 as a sustainability showcase involving passive design with advanced green technologies (University of British Columbia 2017a). Completed in 2011, the building has received both LEED

Platinum and Living Building Challenge accreditation. CIRS is an energy plus building that generates more energy than it uses and also treats its own wastewater. The building is one of UBC's flagship buildings and part of its Living Laboratory Initiative that embeds planning, development, design and operations within research programmes "to test, study, teach, apply and share lessons learned, technologies created and policies developed" (University of British Columbia 2017b).

Respondents from the USI emphasised how sustainability has become embedded in learning and teaching at UBC, for example, as an element in all large first-year courses and many other programmes at UBC. They did not clarify what this means in practice and to what extent this may impact on students, that is whether academics involved in delivering these courses integrate sustainability consistently. But many interviewees who were UBC graduates stated that their career path promoting green building had been influenced by the culture at UBC. Academic leadership on sustainability thinking delivered through specific programmes (e.g. architecture, landscape architecture, urban design, geography and community and regional planning) seems to have influenced the thinking and actions of some UBC graduates, which are now actively engaged with green building in Vancouver and who linked their current practices back to their education and teachers delivering their courses at UBC. Whether students more generally have been and are similarly influenced by UBC's sustainability focus lies beyond the scope of this study and cannot be answered here.

Additionally to degree programmes, learning opportunities involve a number of initiatives that connect students with staff, faculty and organisations and partners off-campus. The experimental nature of the CIRS building where research, teaching and implementation are directly linked provides an example of a living laboratory where faculty staff and students work together to solve operational problems but also collaborate with external partners (e.g. the use of emerging technologies within campus infrastructure). The UBC Social Ecological Economic Development Studies (SEEDS) Programme connects students with staff, with over 100 completed projects on campus. SEEDS projects often involve sustainability problems and opportunities focused on operational aspects of the campus which have been identified by building operators. Identified issues are turned into projects students work on to find solutions and provide recommendations on how problems could be addressed. Students can earn credits by doing a project and are supervised by a faculty member.

UBC also offers a number of paid (off-campus) sustainability internships in the summer (framed as 250 h projects) which link students and researchers with other institutions in Vancouver. The Greenest City Scholars Program is a collaboration between UBC and the City of Vancouver that provides students with the opportunity to work on sustainability projects with the city staff in support of the GCAP (Munro et al. 2016). The programme was started in 2010 counting more than 80 completed projects over the first 6 years. Introduced in 2014, UBC Sustainability Scholars provides an adaptation of the Greenest City Scholars linking UBC students with a range of on-campus and off-campus sustainability partners through funded sustainability internship projects. Partners to date include BC Hydro, FortisBC, Musqueam

First Nation, the Community Energy Association (a non-profit organisation) and a range of UBC departments. The Green Scholar Program has since been replicated at other universities including the University of Alberta, which set up a similar programme in partnership with the City of Edmonton in support of the city's sustainability plan. Similar to the City of Vancouver, UBC is part of international networks spreading examples of best practice and sharing ideas about living laboratories and sustainability projects through publications and conferences.

UBC's objective to act as living laboratory and agent of change involves outreach and sharing of experiments whether successful or failed ones. One representative from the operational side argued:

> It's important that you are constantly kind of testing the boundaries and experimenting and sharing the results with the wider community. I think, that really started to promote UBC in the wider community as being a sustainable campus and that attracted people and attracted interest certainly. (UBC representative, Van15)

Networking and knowledge exchange beyond the local scale involves other universities. UBC participates in the International Sustainable Campus Network and the Association for the Advancement of Sustainability in Higher Education.

Greening initiatives and sustainability leadership at UBC have influenced green building in Vancouver in a number of ways. First, thought leaders at the university have largely helped shape a regional vision of sustainability and green building that has established climate change mitigation as priority, including reductions in carbon emissions and the promotion of environmental goals. Graduates from UBC have been inspired by people like Ray Cole and Peter Oberlander and carried over their vision into the private sector. Second, as educational institution, UBC has incorporated sustainability at least to a certain extent into its teaching programmes, increasing environmental awareness amongst its student body. Third, and as research centre, the university generates and promotes new knowledge on green building including new know-how, technologies but also concerning the research-practice interface bringing together the operational and research sides, students and external partners. Fourth, experimentation with innovative green building design, materials and technologies on campus have set new benchmarks by demonstrating what can be achieved providing both demonstration projects and transferable models. Finally, the deliberate creation of knowledge communities and networks of learning promote the exchange of green building innovations between UBC and other research institutes, government institutions and the private sector based in Vancouver.

6.5 Best Neighbourhood? The Olympic Village in Southeast False Creek

This section analyses the development of the Olympic Village (OV) at Southeast False Creek (SEFC) considering drivers, objectives, implementation processes and the potential for wider influence as a green neighbourhood. From the early

contestations about how sustainability should be defined, whether the area should be a low-carbon living neighbourhood or a model sustainable community, SEFC has been a source of debate and inspiration for many. While it is often referred to as North America's greenest community and it has won accolades such as the LivCom[5] Award for most environmentally sustainable built environment in 2010, SEFC has not been without contention.

The OV development sits within the wider SEFC area of the City of Vancouver, the last parcel of undeveloped waterfront in central Vancouver (Figs. 6.3 and 6.7). False Creek was once the winter home of the people from the Squamish Nation. Before 1860, False Creek was five times its present size (extending north to what is now Pender Street and east to Clark Drive), and pre-industrialisation was a haven for fish and wildlife. Much of the original area has been filled in to make way for subsequent urban development. SEFC has played a significant role in Vancouver's history: many key industries that triggered Vancouver's growth and prosperity were located on or near the site. This includes sawmills, foundries, ship builders, railyards, metalworks and salt distributors. The majority of the SEFC area was owned by the City of Vancouver and was released from the industrial land register in 1990, thus paving the way for neighbourhood development (City of Vancouver 1999).

From the outset, SEFC was intended as a development that would be different from those found in the downtown of Vancouver, and its gestation occurred over a long time frame. The actual building programme was expedited following the announcement that Vancouver (together with the resort of Whistler, north of Vancouver) had been successful in its bid to host the 2010 Winter Olympic Games. Sustainability was a key theme for the 2010 Winter Olympics (Temenos and McCann 2012), and this gave planners and council members cause to think about going beyond greenhouse gas *neutrality* towards a concept of *net zero* in building design (Westerhoff 2015). However, plans for SEFC predated the Olympics: the City Council had previously identified the area for residential development, prioritising "a significant amount of family housing" (City of Vancouver 1999). Early in the debates surrounding development plans for SEFC, consensus emerged around an innovative approach to sustainable urban development, incorporating green buildings and ecological urban development. The city identified the need for public sector leadership in protecting the environment and stipulated that the development should explore the options for embracing sustainable development. However, the term has been loosely interpreted by different actors and as such has been subject to manipulation to suit the various discourses and priorities at play (Kear 2007), leading to disagreements over what should be built, how it should be built and for whom. Westerhoff (2015: 16) argues that far from a simple trajectory from design to construction, the development of the neighbourhood was a highly contested and tumultuous project that was used to articulate entrenched narratives around fiscal

[5] The LivCom Awards were launched in 1997 and focus on international best practice regarding the management of the local environment. The objective of LivCom is to develop and share international best practice, with the further objective of improving the quality of life of individual citizens through the creation of liveable communities.

Fig. 6.7 Above, the completed Olympic Village (front); below, the Olympic Village Square with the historic salt building (in red, front centre) located south of Vancouver's downtown (background) (Photos courtesy of City of Vancouver)

responsibility, government transparency, housing affordability and the high costs of implementing sustainability or being green.

The City of Vancouver adopted the Brundtland Commission definition of sustainable development for SEFC, with its mantra, "to meet the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987), to guide the development of SEFC (City of Vancouver 1999). It was envisaged that:

> SEFC, as a sustainable urban neighbourhood, will integrate into its urban context while protecting and enhancing the social and economic health of its community, as well as the health of local and global ecosystems. (City of Vancouver 1999: 4)

SEFC was also intended as a means of introducing sustainable urban development to wider mainstream actors (developers and designers, for instance), who would, it was argued, thus adopt such measures in future developments in Vancouver and the wider region (City of Vancouver 1999). The Olympics would also offer the opportunity to project these developments at the global scale. However, the proposed developer of SEFC would only be required to progress towards "as many of the social and environmental objectives identified *as reasonable within the limits of economic viability*" (emphasis added); as is common with neoliberal interpretations, sustainable development is prone to being reduced to economic motivations. Moreover, Kear (2007: 329) quotes the cynicism of a private developer who suggests that sustainability was "parachuted in because it was flavour of the month". As such, despite the supposed public sector leadership, there was no unified vision for SEFC. Citizens of Vancouver influenced the form of SEFC, and the definition of sustainability, through their involvement in various participatory processes, but the need to expedite the development to meet the Olympic deadline meant that some ideas fell by the wayside.

The redevelopment of SEFC was about more than designing a low-carbon built environment; it was also designated as a family friendly zone near to the downtown core in the Central Area Plan, in contrast to the mainly empty-nester-dominated core (cf. Kear 2007). This manifested in SEFC having parks, play areas, shops and restaurants as well as transport connections through the SkyTrain's Canada Line rapid transit system in an attempt to attract families back from the suburbs. In terms of ensuring the environmental performance of the buildings within SEFC, LEED silver standard was selected for the SEFC redevelopment, with the goal being to surpass this and achieve LEED Gold. The development was eventually awarded LEED Platinum at the neighbourhood level, thus becoming the second neighbourhood in the world to meet the platinum standard in 2011. The City of Vancouver has since embedded LEED within the rezoning policy following SEFC, so that all new rezoning negotiations must now meet a minimum of LEED Silver standard. However, many schemes, such as LEED, BREEAM, ASHRAE 55 and so on, have been criticised for encouraging a tick-box approach whereby developers can select the measures that are most appropriate or convenient for them rather than adopting a more holistic approach to green building.

The Vancouverism building style alluded to earlier was not deemed an appropriate design for SEFC, but despite this the city engaged Stanley Kwok to develop an initial outline for the development, even though Kwok was closely associated with the tower-podium style so evident on the north side of False Creek. SEFC, many agreed, should be a mid-rise development, focusing on the water and creating a lifestyle and family friendly neighbourhood in the city centre. As an example, the original design foresaw significantly different housing styles, row or terraced housing as a counter to the tower-podium styles. That originally proposed design, however, was not realised, and the reality of SEFC represents a hybrid design, different from both the tower-podium style of downtown and the row houses or the single-family houses found in the suburbs.

It is increasingly recognised that discourses of sustainability have been influential in the politics of local and regional governance and policy-making (Kear 2007; Krueger and Gibbs 2007; While et al. 2004; Temenos and McCann 2012; Bulkeley et al. 2011). While et al. (2004: 1391 in Temenos and McCann 2012) suggest that the recent importance of environmental management in urban governance stems from the convergence of related tensions. These tensions include:

- *Economic imperatives* to revalorise urban space through clean-up efforts, to reduce business costs by using resources more efficiently and to market cities as clean and liveable
- *Regulatory drivers* such as financial incentives from other levels of the state to green the city and legal dictates to mitigate negative environmental externalities and public pressure to reduce carbon footprints and aid in the mitigation of climate change (While et al. 2004: 552).

However, despite this, While et al. (2004) argue that there is an elephant in the room which also heavily influences municipal commitments to sustainability yet concomitantly reduces the positive benefits: an overriding neoliberal political economic and ideological context that demands and rewards *ecologically unfriendly* development, urban entrepreneurialism and business-as-usual economic growth rates while reducing public sector finances and, thus, their ability to regulate or direct investment and development (see also Schindler 2016). This is particularly true for Vancouver where the real-estate sector is tied heavily into international capital circuits (see Ley 2010), a factor which steered debates about the SEFC development with local people concerned about housing affordability and housing for local people rather than more condos for the international elite and overseas investors. Despite the rhetoric of sustainability, many have made it clear that SEFC needed to be profitable, and many of the criticisms of the development have circled around the debts incurred by the taxpayer and the need for the units to sell to repay these debts. As one urban designer (Van20) suggested, “the early days were motivated by economic return [on investment]”. This was particularly problematic given the emergence of the 2007/2008 financial crisis during the development of SEFC. Frequently, the additional costs have been attributed to the cost of building green, thus creating a discourse that sustainability is expensive. One respondent

recalled how, at the time, many conversations followed a similar line, which had a negative effect on the reputation of sustainability and sustainability experts:

> I heard that place went way over budget, and we had to wear that as sustainability people. Whereas a lot of the reasons that it went over budget was because of the granite counter tops in the kitchen. The marble counter tops were flown in from Italy and the fritted[6] glass facade was two million bucks. And there was a whole bunch of stuff that made the whole thing very expensive. And because it was expensive, it didn't sell very well and that was seen as being 'oh well sustainability can be a bit of a boondoggle.' (Urban Planner, Van25)

In the development of SEFC and the OV, the city has demonstrated leadership at two scales—offering local leadership for Vancouverites but also international and global leadership in pushing forward green building as a means of climate change mitigation and municipal urban sustainability strategies. Westerhoff (2015) illustrates how, as a city, Vancouver sees itself as having moral responsibilities (as a wealthy city, performing well in such arenas) to show other cities and countries how it is to be achieved. She continues by arguing that SEFC and later the OV challenged how sustainability was conceptualised within Vancouver, moving out from ecological interpretations to include social and economic concerns.

The Olympics provided Vancouver with an opportunity to showcase its reputation as a sustainable city, thus encouraging the city's politicians, planners and designers to think about innovating in transportation and the built environment—the Olympics led to the rapid realisation of the Athletes' Village in SEFC as well as the development of the Canada Line connecting the airport, SEFC and downtown with fast, clean transit. With the Olympics came the opportunity for Vancouver to experiment with and to promote itself as being in a league of world class green leaders. The city was not going to let this opportunity pass and developed the *Vancouver Green Capital* initiative to promote city policies and actions in sustainability but more specifically the city's economic development. The framing for this promotion was predicated on narratives of business growth and innovation, a clear case of urban entrepreneurialism, combined with environmental leadership. This was an opportunity to sell Vancouver on a global stage, promoting technologies and innovations developed locally that could be exported globally, as well as welcoming foreign direct investment into the region.

As a result of having to design and build at the same time for the Olympic deadline, this created certain opportunities to experiment and embed new ideas that might not have been possible under normal circumstances where building such a development might occur over 10–15 years:

> we wouldn't have done District Energy had it not been for the […] Olympics […] We wouldn't have done urban agriculture if we hadn't had the big challenge to build all this at once. We wouldn't have done a bunch of passive exclusions that are now available throughout the city, in zoning and building bylaws. So staff were learning and inventing as we were going through these approvals really fast. (Urban Planner, Van25)

[6] Fritted glass is a glass with small holes in so that gas can pass through, making it more expensive than traditional glass. This is so that solar gain may be reduced, either with or without solar shades on the exterior of the building and as a means to reduce energy consumption.

This rapid build out phase led to a situation whereby experimentation was occurring simultaneously, in building practices, as well as with governance and policy practices. This unique situation of experimentation meant "we were enshrining these exclusions in council policy as we're doing the buildings" (Van25). This sometimes worked well, whereas at other times it presented challenges, but there was not always sufficient time to permit the ironing out of these challenges.

The ideas embodied in SEFC were based on best practices sought from elsewhere globally, motivated by Vancouver's desire to both emulate the role of the sustainable city and in turn to inspire and influence the next generation of green or eco-cities. As such, this highlights the assemblage of green building and sustainability ideas from within and without, as Vancouver is part of global networks circulating innovations and best practices (see González 2011).

> So we were like if we adopt enough best practices we'll become a sustainability city. We built enough storm water swales, if we have enough LEED or BREEAM buildings we will be a sustainable city. […] we looked at other Olympic villages and we looked at other sustainable developments out there and tried to replicate it. (Van25)

Another urban planner suggests this:

> aspiration to showcase best sustainability practices […] was probably as much motivated by the profound ecological setting we live in, and so this appreciation and the special relationship we have with nature, that we practice daily through development opportunity. (Van20)

Hodson et al. (2016: 131) argue, not in relation to Vancouver specifically, but in discussing the ways that various cities are being made or remade in relation to sustainability and greening initiatives, that:

> this making or remaking the city is presented as a way of contributing to sustainable urban development goals. In particular this involves reduction of carbon emissions through new forms of building standards and construction materials or through reconfiguring the built environment (for example with cavity wall and loft insulation), and by layering new energy networks (for example, district heating or on-site renewables) alongside existing supplies. Underpinning these goals is an efficiency strategy, where designing a new city or retrofitting the built environment and its networks is about saving carbon and producing new forms of energy to enhance growth through more efficient use of resources.

These processes of making and remaking the green city create a tension in existing cities in enmeshing the new green city from within and alongside the materialities of the existing city. In Vancouver, these tensions are most evident in housing affordability and access to housing. Many of the key actors involved in SEFC are staunch advocates, and are immensely proud, of what was achieved and in the degree of ambitiousness, as one urban planner reflected:

> it's interesting […] from a comprehensive approach to all classes of sustainability there aren't many other developments that try to do as much. There are developments that are more energy efficient, there are developments that are definitely higher density, there are developments that maybe have different models of ownership or are more socially just than SEFC. But, SEFC was really ambitious in that it tried to do, tried to be a bit of everything for everyone. From food to energy to storm water to good developments to transportation to sub-equity and social justice issues. (Sustainability policy manager, Van33)

At the time, this ambition was recognised by Roger Bayley, design manager for Millennium Water at SEFC, as meaning that SEFC could influence architecture and planning circles far beyond Vancouver. According to Bayley:

> [SEFC] could have a very significant influence [as] it's being constructed on a scale and in a timeframe that is literally unheard of, except maybe in China. And it's embracing a whole series of innovations that I think many people […] will be extraordinarily impressed with. (Hiskes 2009)

This case study of SEFC highlights the tension between locally informed sustainability and ideas imported from elsewhere. Vancouver has a self-declared moral interest in leading by example for other places in urban sustainability while also wanting to learn from best practices implemented elsewhere. This case study suggests that it is not easy to disentangle endogenous ideas and practices from exogenous so-called best practices but that they are, indeed, dialectically related as one informs the development of the other. In fact, practices like policy tourism (Andersson 2016) and policy boosterism (McCann 2013) complicate this relationship so that local actors are always intimately bound up with practices from places near and far (see McCann and Ward 2012b).

6.6 The Greenest City Action Plan

In 2011 the City of Vancouver introduced a new policy strategy: Vancouver's Greenest City 2020 Action Plan (GCAP). The main goal of the GCAP is to stay "on the leading edge of urban sustainability"(City of Vancouver 2017a) by reducing CO_2 emissions by 33% below the 2007 level by 2020. The plan is seen as a step towards the longer-term goal to turn the city into a 100% renewable city to be realised by 2050. In order to achieve and manage its carbon reduction objective, the plan identifies ten goals (including green building) each with specific targets. Just like EcoDensity launched by Sam Sullivan in the 2000s, the GCAP was largely politically motivated and rooted in the political platform of the centre-left Vision Vancouver party under incumbent Mayor Gregor Robertson (Scerri and Holden 2014). The GCAP's very clear and ambitious goal to make Vancouver the greenest city in the world reflects the political interest to position the city internationally (Scerri and Holden 2014; Holden and Larsen 2015).

The GCAP has been interpreted by Westerhoff (2015: 68) and others as constituting the building of an urban brand and a shift away from the moralising tones of sustainability towards a concept, of being green, that is easier to understand and more celebratory than punishing. The GCAP has since earned international recognition. For example, the World Green Building Council awarded it Best Green Building Policy in 2013. In that sense, the GCAP follows the launch of Vision Vancouver's Green Capital plan which responded to both economic and environmental challenges by promoting Vancouver as attractive and safe place for external investment as well as brand for local economic outputs (Vancouver Economic Commission 2011). The plan has been criticised by some as strongly entrepreneur-

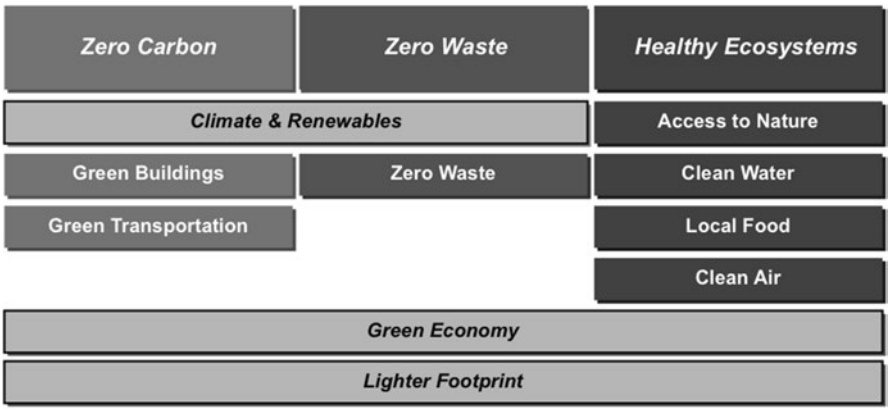

Fig. 6.8 Goal areas of the Greenest City Action Plan (Illustration: Ulrike Schwedler, based on City of Vancouver 2017b)

ial and post-political approach to greening the city, which may risk increasing inequalities within the city (Longhurst 2013a; Witt 2013).

The GCAP was largely influenced by the work of a blue-ribbon expert panel including thought leaders and external advisors that in February 2009—only a few months after Mayor Robertson's election—was tasked by Robertson to develop a strategy to turn Vancouver into a world leading green city. This group of scientists, planners and lawyers screened and evaluated urban greening approaches, targets, indicators and implementation strategies from leading green cities worldwide. The results of the advisory panel were published in the 2009 Vancouver 2020: A Bright Green Future report (City of Vancouver 2009). The report identifies ten goals grouped into three areas: (1) zero carbon, (2) zero waste and (3) healthy ecosystems (Fig. 6.8). Nine of the ten goals had been identified through international screening of best policies and practices but the tenth goal, local food, had been identified as unique to Vancouver. Rather than following federal or provincial standards and policies, the process illustrates the city's focus on international standards and leadership. The report also identified 15 more specific targets under the ten goals. In respect to green building, the GCAP identifies two targets: it seeks (1) to have "all buildings constructed from 2020 onward to be carbon neutral in operations" and (2) to achieve a reduction of "energy use and greenhouse gas emissions in existing buildings by 20% over 2007 levels" (City of Vancouver 2012a: 23).

In order to develop a more specific approach to manage and implement the strategy, the City of Vancouver established the Greenest City Action Team, consisting of city staff that were divided into ten thematic groups to identify strategies to meet goal-specific targets supported by external advisory committees including business leaders, academics, professional associations, non-profit organisations and others (Federation of Canadian Municipalities 2013; Scerri and Holden 2014). What was novel about the organisational structure of the GCAP was the interdisciplinary character of the working groups that spanned different City departments. Rather than

separating sustainability out into a separate department, sustainability goals in the form of GCAP goals and targets are now woven into different departments and city operations that engage with these issues as an integral part of their responsibilities. The planning process was accompanied by public engagement. The earlier phases involved open forums, while a wider public engagement process was launched following the presentation of the first draft of the GCAP in 2010. According to estimations by the city, a total of 35,000 people from around the world actively participated in the various formats including face-to-face workshops, idea slams, and Internet-based tools, involving 60 city staff, 120 organisations and thousands of individuals (Robertson 2016). The GCAP was approved by the City Council in 2011 and released in 2012.

In respect to its implementation, the GCAP differs from its predecessor EcoDensity which was largely restricted to the adoption of best practices (identified as densification). The GCAP in contrast illustrates a transition from a strategy-based to a target-based approach of urban sustainability by setting quantifiable and measurable targets to monitor progress. In fact, monitoring, reporting and accountability were seen as a core piece of the strategy's success. In the view of one former city staff:

> In order to be the greenest city in the world, we can't just adopt these best practices. We actually need to hit these targets […] so it was really the price of metrics, quantification of sustainability outcomes and this kind of target-based approach. (City of Vancouver staff, Van16)

Progress towards GCAP goals is evaluated and communicated through yearly implementation updates published by the Greenest City Action Team (e.g. City of Vancouver 2012b, 2013, 2015, 2016). What made the GCAP innovative were less the goals and components of the strategy themselves that drew mainly on existing tools from esteemed green cities around the world, but rather the identification of quantifiable targets or proxies and the ambitious time horizon for implementation, monitoring and recording. Measures were chosen for their suitability to be followed-up on and recorded every year. In some cases, this required adjusting identified targets, in order to allow for quantifiable action and progress.

In order to reach its green building targets, the GCAP relies mostly on bylaws but also utilises some financial tools (incentives schemes). One respondent noted that, in his view, Vancouver in the past has strongly relied on regulatory tools that apply to its whole jurisdictional area in order to achieve gradual change rather than actor- or sector-specific incentive schemes (Former City Staff, Van16). Regulatory tools are implemented through the Vancouver building bylaws that came into effect on 1 July 2014 and that have been updated since, and will be updated regularly in the future to tighten energy efficiency requirements for new one- and two-family homes and energy audits and upgrades for existing buildings under renovation. The City of Vancouver has described its building code to be the greenest in North America (City of Vancouver 2012a) which has been backed up by the CAGBC (Wooliams 2014). Another set of regulatory tools to help achieve green building targets are the City of Vancouver's rezoning bylaws:

- The Green Building Policy for Rezonings requires the minimum of LEED Gold (as well as reduction in energy costs) as part of all rezoning applications after 25 June 2014.
- The Rezoning Policy for Sustainable Large Developments (amended 16 May 2013) prescribes additional actions beyond the rezoning requirements for developments involving a site size of 8000 m^2 and above or containing a minimum of 45,000 m^2 new floor area. These include a sustainable transportation strategy, sustainable rainwater management plan and a solid waste diversion strategy, amongst others.
- The General Policy for Higher Buildings applies to buildings exceeding the building height under current zoning policies and prescribes 40–50% reduction in energy consumption from 2010 levels for all higher buildings.

All three rezoning bylaws hence allow increased building stock through higher density or height if stricter sustainability standards are implemented.

The success of the GCAP is measured and recorded annually through the publication of a progress report that publicises the progress on identified targets. Quantified and target-based approaches of environmental performance measures are both easy to communicate and effective in promoting the city's green achievements. The GCAP advanced Vancouver's sustainability policy considerably through the identification and formulation of hard, quantifiable targets and measurements, but there are weaknesses to the approach (Affolderbach and Schulz 2017). Criticisms of quantified approaches to greening more generally, including carbon reduction, have grown within urban studies and related disciplines. While et al. (2010) argue that local or urban targets are likely to be restricted to those that can be achieved at the local scale. They point to the challenge of needing to draw (manageable) boundaries in order to quantify carbon emission in space (see also Kenis and Lievens 2016). This is a real challenge in many urban jurisdictions where infrastructure provision and services (including energy, waste, transportation, etc.) are delivered across municipalities as illustrated by the example of Metro Vancouver. Holden and Larsen (2015: 12) raise concerns in respect to the use of indicators in the GCAP arguing that "the sense of objectivity embedded there, at the same time, may cast a smokescreen over whether the actions that are justified by it are also the most desired ones".

Interview respondents had similar concerns to those identified in the literature. For example, respondents questioned whether prescribed standards (in particular LEED) were well suited to deliver best outcomes. Certification schemes including LEED are criticised for relying on technological fixes as light green strategies, and discussions revolve around the transferability and adaptability of green building models (Boschmann and Gabriel 2013; Faulconbridge 2015). Tools like LEED that helped to communicate and measure greening and green building more specifically were seen as extremely valuable in promoting urban greening by clearly communicating different standards to the public. At the same time, LEED has been described as becoming restrictive and suggested to have lost meaning as the building sector was "just chasing points" (Green building expert, Van03). Another challenge of

quantified approaches relates to the identification and availability of proxies that are used to measure progress towards set targets. Questions were also raised regarding the extent to which building bylaws can be enforced and monitored properly in order to prevent circumventions and breaches of green building obligations. For example, respondents argued that relative measures of energy efficiency could be manipulated by developers through an increase in expected occupant numbers that reduce energy consumption per occupant. Hence, interview respondents emphasised ambiguities in respect to implementation, enforcement and monitoring of GCAP goals.

Success of the GCAP has been largely attributed to the positive narrative it presents of urban greening in and around Vancouver. The initiative includes elements of public participation that seek to gain stronger support and a buy-in from the local population. The participatory element is also a core feature in the implementation strategy that relies on citizen engagement to achieve some of its targets. The framing of the policy initiative around municipal empowerment and climate change action through identified goals of economic development, green jobs and investment into infrastructure places emphasis on liveability and quality of life that resonate with the broader public as emphasised by a number of respondents. This approach has been described both as inspirational and celebratory. The monitoring of progress towards set targets and the involvement of citizens help enforce local identity and a sense of ownership amongst the local constituency. Even though not necessarily foreseen as such from the conception of the plan, one of the targets—to achieve a lower footprint—is based on public engagement using the proxy of the number of people empowered by a city-led or city-supported project to take action and act as agents of change.

While the population was reported to generally support the GCAP, many respondents highlighted unclear communication in respect to what was meant by green building, energy efficiency and expected benefits. Similarly, the objective to go carbon neutral was criticised for being unclear, and respondents were not sure how to interpret the aim. Further, there were definitely tensions around specific pieces of implementation, particularly as they relate to aspects of affordability (Senior City Staff, Van14). For example, the three rezoning policies mentioned above offer buy-outs to developers. They allow increases in the floor area for developments at the cost of stricter environmental standards. Critics see this as a municipal sustainability strategy that is catering towards the rich as developers will be able to increase their profits through increased floor area for sale, pass on added costs of upper segment housing to affluent buyers and investors and further inflate Vancouver housing prices while reducing the share of affordable housing. With affordability currently seen as one of the biggest challenges in Vancouver, greening the built environment is seen by many as further inflating the real estate and rental market (Witt 2013; Longhurst 2013a). Even leading city staff acknowledged the challenge of green building within the context of an affordable housing crisis: “we will lay on more energy requirements like triple pane glass windows or whatever adds cost to construction. And so trying to balance affordability and greening is a challenge” (Senior City Staff, Van14). While innovations in green building can offer long-term finan-

cial benefits, these are currently seen as added upfront capital costs by developers and home buyers alike as illustrated by the quote. Payback is further stretched by the temperate climate and low-energy prices. This is particularly the case for retrofitting existing buildings where costs are frequently seen as outweighing potential savings reflected in very low interest of home owners of one- to two-family homes to upgrade their homes to higher energy standards. Benefits are more real for commercial buildings where energy cost savings are much more tangible for operators, but construction of commercial space in Vancouver has been, relatively speaking, at small volume (Van09, Van04). In general, there is increased concern about house ownership and increased real-estate prices associated with foreign investments into the Vancouver housing market. As a result, Vancouver introduced a foreign buyers tax in August 2016 applying a 15% additional tax within Metro Vancouver to foreign buyers who are not Canadian citizens or permanent residents in an attempt to calm down Vancouver's housing market (Kassam 2016).

The GCAP is not only directed at Vancouver residents: the City of Vancouver pursues an outward strategy during all phases of the GCAP from conception to progress assessment (Affolderbach and Schulz 2017). Vancouver's quest to present itself as greenest city takes place at different spatial scales. The quantified approach to measure performance and progress offers the basis for comparison and illustrates the city's ambition to perform well. It has been used by the city to measure its performance globally in comparison to other cities and to claim leadership. This is illustrated by the first report of the Greenest City Action Team (City of Vancouver 2009) that uses examples of world leadership for each of the identified categories including, for example, the City of Berkeley on green building retrofits. A former City of Vancouver employee described the strategy as follows:

> We [City of Vancouver] will never beat Oslo with its 80% district energy. But if we do well, get second place in every category across all ten disciplines then we would be the first green city with the other scoring metrics. So our principle was to do very well in all the categories. (Former City of Vancouver employee, Van07)

The conception phase of the policy involved global scoping and identification of vanguard cities that were well ahead of Vancouver and could provide expertise that could be brought in and applied to Vancouver (e.g. Copenhagen and Oslo on district energy).

Achievements are similarly measured and presented in comparison to policy initiatives at the regional scale. For example, the GCAP implementation update includes relative positioning against the green province of BC stating that the update of the Vancouver Building Bylaw will require family homes to be "50 per cent more energy efficient than the 2012 B.C. Building Code" (City of Vancouver 2013: 15). The relationship between municipalities within Metro Vancouver is commonly described as collaborative where a number of services are jointly provided and can only be realised collaboratively (e.g. public transportation). In this sense, Vancouver's endeavour to act as green city leader suggests inconsistencies between different scales and actors where leadership is claimed at the city scale, but metrics and implementation may rely on the larger region. A representative of the City of North

Vancouver, which is itself relatively progressive in the field of green urbanism, described the relationship as follows:

> When we have collaborated with them [City of Vancouver], they have said: "Let us be the first past the post, and we will share everything with you, but can you continue six months after we have started"? (Van09)

While the strategic positioning of Vancouver within the larger agglomeration primarily focuses on branding a green image of the city (and larger region), it also offers legitimation and models to follow for neighbouring (and further afield) communities.

6.7 Conclusion

This chapter discussed some of the origins and directions that characterise green building transitions in Vancouver. The context and history of the place has been emphasised both in the literature and by respondents highlighting the role of alternative milieus (Longhurst 2013b). While the example of UBC illustrates the role of universities as niches for green building innovations that provide a different perspective than the more general urban context, the cases of SEFC and GCAP provide examples of urban experiments in policy and practice. Positions on the success of SEFC and GCAP are mixed. Critics pointed to increased housing prices and an affordability crisis with little demand for green building and weak interest in changing energy consumption and life styles. Others have argued that increased living costs are solely linked to land value rather than green features. Green building in all three examples was presented as positive frame to communicate sustainability. It consists of a transition that seeks to empower citizens involved in the process relating to what Glave (2006: 54) describes as "nouveaux-green movement", a transition that does not require radical change but a "quarter step" through adjustments to our lifestyles that are doable.

Despite the criticisms of the OV and the lengthy debates that preceded the actual development, SEFC is now a popular and well-used space. A key question is what can the development of the OV tell us about building ecologically and socially informed housing in urban areas? Similarly, the GCAP has increasingly been criticised in respect to a neglect of social sustainability and affordability in particular. How can we utilise experiences from policy initiatives such as Vancouver's GCAP? Can or should SEFC and GCAP inform similar developments elsewhere or should such developments be based on locally situated and contingent conditions, negotiated between residents, citizens, developers and policy makers? How key was the role of the City of Vancouver in facilitating the development of SEFC? Questions such as these highlight the tensions involved in being a competitive and emulative city in terms of providing leadership and learning from others. Navigating these questions is not a straightforward process, and being the greenest is an always contestable and evolving process.

Experiences of green building, as well as particular transport concepts, in a given place:

> feature as success stories, which are carefully crafted and persuasively told, strategically packaged in codified form and moved around as embodied practitioner knowledge, unpacked and reshaped in the re-telling. (Sengers and Raven 2015: 170–171)

Such experiences from particular places can be mobilised by niche actors in their efforts to diffuse niche practices elsewhere. Vancouver exhibits examples of such niche activities as exemplified by UBC, SEFC and GCAP, which have all been imported to, as well as exported from, the region in relation to green building, but also wider urban sustainability measures such as liveability and urban cycling. Green leadership has been largely celebrated as made in Vancouver, but leadership involves at least as much learning from elsewhere as providing lessons for others. This includes collaboration and exchange between the different municipalities in Vancouver but also with cities further away.

Green building initiatives from Europe in particular have been important for key decision-makers in Vancouver, whether these were examples from cities, such as Copenhagen and Freiburg (Chap. 5), or models such as passive house, building labels and community design. The International Olympic Committee also played its role in respect to SEFC. But despite European sources of inspiration, definitions of green building differ from the European approach, and there was shared recognition amongst respondents that Europe was (still) leading green building transitions. At the North American level, however, most respondents claimed a leadership position for Vancouver but also acknowledged the practice of green marketing and place building that may have weakened greening efforts redirecting the focus to branding and marketing. Many involved in green building initiatives mentioned competition with other cities around green leadership, but Vancouver's claim of leadership may be more rhetorical than acknowledged. Rather than exporting Vancouver models, respondents argued that input was often sought and experts from elsewhere invited to come to Vancouver.

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Chapter 7
Brisbane: A Disrupted Green Building Trajectory

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Abstract Brisbane in Australia is not a renowned city for green building and sustainability. While Sydney and Melbourne both enjoy international recognition for their sustainability efforts, Brisbane has struggled to keep up with green innovations in the building sector and rarely catches the attention of green building practitioners and researchers. Despite its current struggles, Brisbane looks back to relatively early greening initiatives including research and experimentation with alternative solar energy technologies. During the 1990s, the city defined ambitious goals for climate change mitigation, but the following decades have been marked by changes in political prioritisation and agenda setting. This chapter traces developments in green building in Brisbane since the 1960s, which are characterised by discontinuity and hence highlight the importance of the spatial context of green building transitions. Green building in Brisbane provides valuable insights into what can happen in the face of policy roll back at different spatial scales. The lack of political support for green building has been partially filled by private investors for the commercial sector, but recent solitary not-for-profit projects focused on affordable and social housing also provide niches for green building innovations.

7.1 Introduction

This chapter explores green building transitions in the metropolitan area of Brisbane, Queensland, Australia. The Brisbane case study provides valuable insights about ambivalent sustainability transition processes in both the residential and commercial building sector. In contrast to the green forerunner or lead cities Freiburg (Chap. 5) and Vancouver (Chap. 6), Brisbane's history of green building is comparably short and characterised by contradictions and discontinuities. However, in the early 2000s sustainability transitions gained momentum when the challenges around increasing consumption of energy, water and the provision of infrastructure were addressed by policy-makers, practitioners and researchers. While significant shifts

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Fig. 7.1 Brisbane's inner city in 2015 (Photo: Sebastian Fastenrath)

towards greener commercial buildings can be identified in Brisbane's inner city (Fig. 7.1), there has been comparably little change in the residential building sector. A broad uptake is yet to occur for new or renovated homes, which consider energy and water efficiency and environmental friendly materials and designs holistically.

This chapter highlights challenges, distractions and processes of policy and industry resistance against sustainability transitions drawing on work in transition studies and urban sustainability (Geels 2014; de Gooyert et al. 2016). It provides insights into the ambivalent green building pathways based on empirical data gained through the GreenRegio project's kick-off workshop held in March 2014 in Brisbane (Sect. 4.3.2), 30 expert and stakeholder interviews conducted in April 2014 and June–July 2015 and in-depth analysis of policy documents and secondary data by property industry organisations.

Section 7.2 overviews key specificities of Brisbane's building and construction sector to highlight its embeddedness in the urban and regional context including Brisbane's dynamic population growth, local building approaches and the subtropical climatic conditions. Section 7.3 sheds light on Brisbane's green building pathways by tracing back significant developments and shifts in knowledge generation, building practice and institutional settings. The challenges around transitions in the residential building sector will be focused on by analysing the interplay of multifaceted processes and involved actors including transition agents and transition detractors (Fastenrath and Braun 2016). Discontinued political support and path dependencies in the local building and property industry will be explained. A more detailed perspective on single aspects and micro case studies within the pathways will be integrated in Sects. 7.3.3 and 7.4 including alternative green building approaches in the residential multi-storey apartment sector. Section 7.5 presents key conclusions of the Brisbane case study.

7.2 The Context of Green Building in Brisbane

7.2.1 Dynamic Regional Population Growth

Located along Australia's east coast, Brisbane is the capital of the Australian state of Queensland and one of Australia's oldest cities. In 2016, 2.3 million people lived in Greater Brisbane accounting for almost half of Queensland's population of 4.8 million inhabitants (ABS 2016). It is the third most populous Australian city—behind Greater Sydney (4.8 million inhabitants) and Greater Melbourne (4.5 million inhabitants). The city is built on the coastal plain framed by Moreton Bay to the east, the Great Dividing Range to the west and centred around the Brisbane River.

Over the last two decades, Brisbane's building sector has been strongly influenced and characterised by rapid population growth within its urban agglomeration. During the 2000s and until the early 2010s, Brisbane experienced one of Australia's highest capital city population growth rates of more than 2% per annum. In that timeframe, the Brisbane metropolitan area has provided new homes for more than 500,000 residents amounting for more than 40,000 new residents per year (ABS 2016). Since the 1970s, Brisbane and the adjacent regions, Sunshine Coast and Gold Coast, have merged to form a 200 km city along the coast of South East Queensland (SEQ) (Fig. 7.2) (Spearritt 2009). New and large master-planned communities have been initiated in SEQ. The biggest development, Aura in Caloundra on the Sunshine Coast, will provide homes for more than 50,000 people (Stockland 2017). By 2041, the population of SEQ is expected to have increased by two million people (QLDGov 2016). The draft of the SEQ Regional Plan released in October 2016 targets more than 230,000 new homes over 30 years to keep up with the rapidly growing population (QLDGov 2016). Similar to other Australian and many North American cities, Brisbane's urban structure is characterised by low density and urban sprawl. This is a result of former urban planning approaches, which were in place until the 1990s, in conjunction with the common Australian lifestyle preference of large properties and detached houses in suburban areas. Even though dwellings are becoming smaller with an average floor area of 241 m^2, Australia's new-build dwellings are still amongst the largest in the world (ABS 2013).

7.2.2 Resource Efficiency Through Improved Urban City Form

The environmental, economic and social consequences of dynamically growing cities and urban sprawl in Australia have been explored and discussed since the 1980s (e.g. Freestone 2007). Newman and Kenworthy (1989) argue that the reduction of car dependency and energy consumption are key challenges in Australian urban planning. In reaction to these challenges, urban consolidation planning policies were introduced by different planning authorities. The main goals of these policies

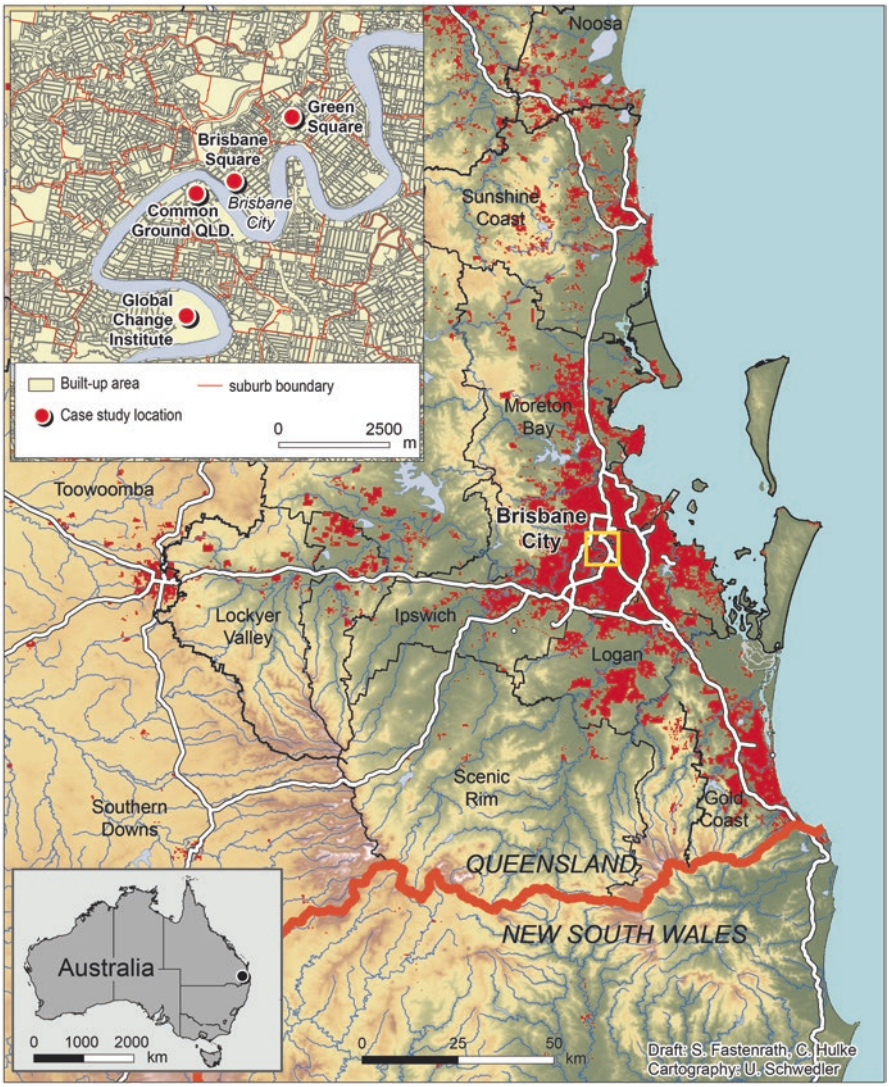

Fig. 7.2 South East Queensland (SEQ) and Brisbane including case study locations (Cartography: Ulrike Schwedler)

were based on the preferences of property and infrastructure developments on inner-city brownfields, higher density through smaller land lots and a higher number of units in multi-storey buildings and improved access to public transport (McLoughlin 1991; McCrea and Walters 2012). Over the last decade, planners at the Brisbane City Council (BCC) have implemented new sustainability-oriented planning approaches as a response to the sustained population growth and urban sprawl. The Brisbane CityShape 2026 released in 2006 follows the principles of a

polycentric urban model with higher density and growth corridors. These planning principles were partly the result of community consultation. The council released a draft for comment and used the responses to identify how Brisbane residents would like to see Brisbane growing into the future. More than 60,000 people provided feedback to the planning draft (BCC 2006). One interview respondent described the outcomes of this process as follows:

> We got a mandate for increased density, a city of nodes and corridors. [The people said:] If we're going to have more density we want better green space, we want better services or access to services. And not surprisingly: Transport, sustainability, green space and affordability were the four top things. Probably the four top things in every city around the world, everywhere. (City planner, Bris03)

The current draft of the SEQ Regional Plan sets similar priorities as it seeks reductions in "greenhouse gas emissions by adopting patterns of urban development that reduce the need and distance to travel and encourages the use of active and public transport" (QLDGov 2016). However, significant changes in building performance are not anticipated.

7.2.3 Building and Construction in Brisbane's Subtropical Climate

The region-specific climatic conditions play a substantial role in Brisbane's building sector. Intensive heat, droughts or wet periods occur on a regular basis. Brisbane is affected by subtropical climate with hot and humid summers and dry and mild winters (AUSGov 2017). In response to the subtropical living conditions, the climate-adjusted residential building concept known as the Queenslander has been widely adopted since the mid-nineteenth century throughout Queensland and northern parts of the state New South Wales (Fig. 7.3). The characteristics of Queenslanders, which are valued as important elements of Queensland's historical heritage, include a simple timber lightweight construction with a highset on stumps, a corrugated iron roof and a sheltered corner of the building. The verandas are generally understood as distinctive Australian semi-outdoor lifestyle essentials (QueenslandMuseum 2017).

Nevertheless, the Queenslander's energy efficiency performance is questionable today. During the summer months, the buildings are quick to heat up as a result of the high thermal conductivity of the tin iron roofing and the poor insulation of the buildings. In winter, when night temperatures can drop down to 5 degrees Celsius, it is challenging to maintain temperatures and heat up the buildings. The growing use of air conditioning along with the new typical lightweight residential buildings significantly contributed to Australia's household energy consumption during the summer period (December to February) (Miller and Buys 2012; Miller et al. 2012). Two thirds of Queensland's households use one or more air conditioners during the warm summer months (ABS 2010). As Fig. 7.4 shows, the Australian residential sector and the sector of commerce, services and trade (where energy is mainly consumed in buildings) are responsible for around 15% of total energy consumption in Australia

Fig. 7.3 Traditional Queenslander in Brisbane (Photo: Sebastian Fastenrath)

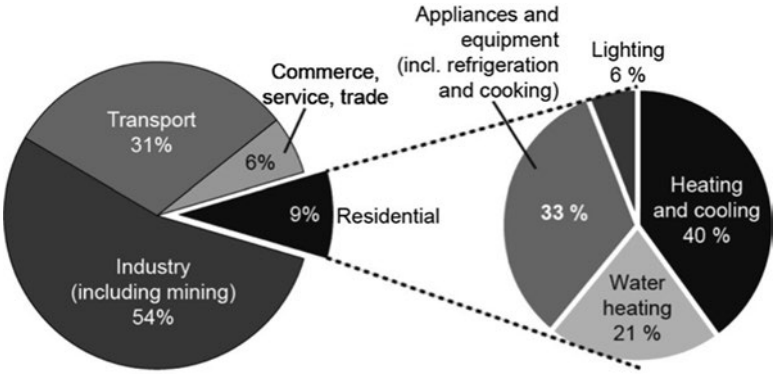

Fig. 7.4 Energy consumption in Australia by main sectors (left) and the residential sector (right) in 2013 (Own illustration; data source: AUSGov 2015)

(AUSGov 2015). Room cooling and heating and water heating are the main sources for energy consumption in the residential sector.

Effective use of ventilation and air conditioning to ensure high living standards, while concurrently contributing to resource efficiency and climate change adaptation, is a key challenge in the greening of Brisbane's building sector. Greener building design solutions that consider shading and natural ventilation concepts as key elements of subtropical architecture have been researched for decades, especially in Brisbane (Szokolay 1975).

7.3 Green Building Pathways in Brisbane

7.3.1 Early Pioneering Phase (1950s–1980s)

Before the 2000s, green building in Brisbane was mostly a niche phenomenon. However, earlier innovative initiatives were described by a number of interviewees (Bris07, Bris21, Bris23, Bris26). One Brisbane architect and early green building pioneer explained that just a few local specialised architects and researchers had been familiar with the topic during the 1960s and 1970s:

> There was certainly an awareness of passive solar design back to the 70s. There was The Club of Rome report in the late 60s, the oil shock in the 70s. But it was a niche. A small percentage of the profession. (Architect, Bris07)

This position was shared by another architect who recalled that

> The building industry and for that matter architects weren't particularly interested in energy and architecture. In 1974 no one even related those two things. […] New Zealand had energy regulations for houses in 1979. So when you designed a house in New Zealand you had to think about energy, about glass and insulation. In Australia we ignored all that until the 1990s, because we didn't have any Section J requirements [non-mandatory energy efficiency requirements within the Building Code of Australia]. (Architect, Bris21)

Nonetheless, Brisbane has been an important hub for knowledge generation and experimentation in the fields of solar energy and solar building design since the 1950s. Research and experimental projects at the University of Queensland (UQ) were internationally recognised. In the 1960s, a committee on Solar Energy in Tropical Housing was working at UQ on solar housing designs for tropical climates (Baverstock and Gaynor 2010). Technological innovations such as solar absorbers on roofs to generate hot water and energy were developed. The researchers at that time were members of the Australian and New Zealand branch of the international Association for Applied Solar Energy, which later became the International Solar Energy Society (ISES). An interviewee within the research field highlighted the special role:

> It is one of the oldest academic networks. I think they started in the 1950s or 1960s. So that network was really important. They pushed energy efficiency and renewables before any work started in the 1970s and 1980s. (Researcher, Bris26)

In the 1970s, Professor Steven Szokolay, a solar energy and building design pioneer and renowned architect, started at UQ. As one of the first academics, he taught on the subject of solar energy and building at the university level. His books and journal articles on solar architecture were published internationally (e.g. Szokolay 1975). As the president of the Australian New Zealand branch of ISES and as the editor of the publication Solar Energy in Australia and New Zealand, he held a strong leadership role throughout the 1980s (Baverstock and Gaynor 2010). His book *Introduction to Architectural Science: The Basis of Sustainable Design* (Szokolay 2014), which was published in 2014 in the third edition, was still named as internationally recognised during interviews (e.g. Architect, Bris21). In addition

to pioneer research in the field of architectural science, Szokolay designed green progressive buildings. In 1978 he built an air-conditioned solar house in the Brisbane suburb of Mount Cotton. A developer described Steven Szokolay as

> one of the heroes of the solar movement [but] he was just too early. The leading architect around solar [energy] back in the 1970s. […] If he'd been around 20 years later he might have had a huge impact on Brisbane. (Developer, Bris23)

Interview partners widely agreed that valuable knowledge about green and solar building principles had been generated in Brisbane's academic environment in the 1970s. A broad uptake of green building practices, especially in the residential sector, had not yet taken place. During the mid- and late 1980s, energy efficiency firstly became a topic in large public and office buildings in Brisbane and other Australian cities. An influential Brisbane-based engineer (Bris18) explained how personal learning by doing had been important for individual career paths in green building as well as further green building developments. First attempts to reduce energy consumption lead to significant cuts: "In the first 18 months we [construction team] were able to reduce the energy by 40%" which encouraged those involved to push further.

Several interview partners mentioned that during this decade Brisbane hosted the 1988 World Expo. The mega event, which attracted more than 15 million visitors, was held at Southbank, a former inner-city industrial and harbour area along the Brisbane River across from the central business district (CBD). A key goal in the run-up of the Expo was the large brownfield redevelopment to a cultural, educational, residential and recreational precinct. New ideas in planning, building design and construction have been applied in that context. A Brisbane-based leading industry actor (Bris10) argued: "A trigger event in Brisbane was Expo 88. […] Brisbane created a site to be an exemplar of technology and green processes at the time. It was pretty early days".

7.3.2 Formation of Policy Pathways and Local Window of Opportunity: The 1990s

Respondents generally agreed that the topic of green building became more discussed in Brisbane in the 1990s when policies towards more sustainable modes in building and construction started to emerge capturing issues such as energy efficiency, ecology and sustainability which had not played an important role in planning policies before. A planner at the Brisbane City Council involved in the City's planning at that time described the inadequate role of sustainability in city planning:

> Before the early 1990s, the word environment did not exist in Queensland [planning] statutes. In 1993, the word environment was mentioned in two cases in our town plan at the time. (Bris03)

Amongst other interviewees, an important stakeholder in Brisbane's property development industry also highlighted the start of sustainability policy-making as an important stepping stone for green building in Brisbane:

> I suppose it was throughout the 1990s. Sustainability or as it was called ecologically sustainable development […] was sort of at the forefront of thinking around public policy in urban planning in Australia and there was sort of a parallel process, I guess, through the 1990s there was greater interest in green building. (Developer, Bris23)

Workshop participants and interviewees named the National Strategy for Ecologically Sustainable Development, which was released in 1992 by the Council of Australian Governments (COAG), as marking the beginning of green building policies in Australia. For the first time, there was an established political goal to improve the energy efficiency of residential and commercial buildings. One of the objectives of the strategy was

> to improve the energy efficiency of residential buildings and domestic appliances; and to influence householders to become more economical in their use of energy, and to switch to energy sources with lower greenhouse gas emissions. (COAG 1992)

To achieve these ambitious objectives, the COAG identified three key actions: first, the development and implementation of a nationwide House Energy Rating Scheme; second, the development of minimum energy performance standards for major domestic appliances; and third, a national scheme for mandatory energy performance labelling of major domestic electric, gas and solar appliances (COAG 1992). As a result, a number of policy initiatives and regulations were implemented in the years following. In 1993 and 1996, the Building Code of Australia, which sets provisions for design and construction of buildings and other structures throughout Australia, was renewed and adopted by the different states. Also, state-level policies were introduced around the same time, namely, the Queensland Environmental Protection Act in 1994 (QLDGov 1994) and the Integrated Planning Act in 1997 (QLDGov 1997). Concurrently, the local councils were encouraged to implement sustainability ideas.

In the late 1990s, BCC officers in the sustainability unit worked out ideas for a House Code and an Energy Efficiency Code as part of the Brisbane City Plan 2000 (BCC 2000). An involved stakeholder and planner in the City Council (Bris03) highlighted the special role of the City Plan as a trigger for urban sustainable development arguing that for housing, the City Plan 2000 was "ahead of the game [as] for a new house you had to achieve a certain rating on your house". The requirement to achieve a rating on a house was new at the time and hence challenged established practices but was approved by the Council.

Even though the innovative ideas of integrating building regulations into the City Plan were accepted by the Brisbane City Council, they were not approved by the Queensland State Government in the early 2000s highlighting the political struggle. The described resistance of policy-makers at the state level against greener practices was highlighted in interviews and by participants at the GreenRegio kick-off workshop. Despite the rejection at the state level, a draft of the sustainable housing code and the ideas of improved housing performance were brought to the South East Queensland Region of Organisation of Councils (SEQROC) and were discussed and applied to demonstration projects.

7.3.3 Green Building in the 2000s: Transformations and Resistance

7.3.3.1 The Residential Building Sector

The BCC continued to be a strong supporter and forerunner in green building transitions in the following years. A dedicated city administration followed ambitious sustainability goals under Australian Labour Party Lord Mayors Jim Soorley and Tim Quinn (from the 1990s until 2004) but also the first four years under Liberal Party Lord Mayor Campbell Newman (2004–2008) who had to govern with a labour-dominated cabinet. In the early 2000s, resource efficiency and green building and construction started to become a prominent topic in local policy-making and in the property and construction industry as confirmed by a researcher (Bris26). While the implementation of local building requirements was not incorporated into a city own building code, City Councils in SEQ started to actively influence the transition of the local building and construction sector by supporting green building design and technologies and bringing together stakeholders of the building and construction industry (Architect, Bris24). As a result, a number of small-scale innovative demonstration projects in the residential sector were developed in the early 2000s.

A number of interviewees (Bris08, Bris11, Bris23) stated that the Sydney Olympics in 2000 were an important milestone and trigger for the adoption of greener building and construction practices in Brisbane. In addition to water and energy efficiency, reduction of waste, green building and construction played a key role during the first green Olympic Games (Braun 2000). A large number of green building considerations and practices were incorporated into building design and construction including, for example, orientation of the buildings considering sun paths, energy-efficient passive solar building design, recyclable and recycled building materials, non-toxic paints, solar hot water systems, water recycling facilities and solar panels.

A prominent example in Brisbane that applied a similar holistic approach to green residential buildings was the GreenSmart Village in Springfield Lakes (Lendlease 2017a), a master-planned community developed by the property developer Lendlease located 28 km southwest of Brisbane's city centre in 2004. The demonstration project was realised in cooperation with different key stakeholders such as state government authorities, the Ipswich City Council, builder's professional associations, architects, builders and research institutions. The goal was to provide different sustainable display houses to set a new benchmark for developers and the home building and construction industry. The learning processes, experiences made and also information about used materials and costs and benefits were shared with industry actors. The overarching goal was to build innovative homes integrating passive design elements for smaller lots, rainwater capture and reuse, energy and water efficiencies and other simple design elements. Using the concepts of the sustainable housing code which were discussed at SEQROC at that time, the

following green building design and sustainable technological elements were applied in the display houses (Luxmoore 2005):

- Passive design (orientation, insulation, glazing, higher ceilings, shading)
- Energy-efficient appliances (lighting, fans, white goods)
- Greenhouse gas efficient hot water system
- Water efficiency (AAA shower roses and taps, dual flush toilets, AAA or higher rated white goods)
- Water supply for whole-of-house use (tanks, water quality devices/filters, pump, irrigation)

In addition to these property and building industry-driven demonstration projects, the Brisbane City Council continued their support for transitions in the building sector. The report Our Shared Vision—Living in Brisbane 2026 (BCC 2006) highlights the importance of a "well-designed and responsive built environment" to reach the target of a carbon-neutral Brisbane and Council in 2026. The Brisbane City Council demonstrated leadership by introducing a sustainable built environment policy for city-owned and city-leased buildings. The City Council explained that

> the design and construction of our office buildings will significantly contribute to our vision for Brisbane. Vast quantities of materials (timber, concrete, metals, etc.) and energy are required for the construction of offices. (BCC 2007b)

Furthermore, Brisbane's policy framework Plan for Action on Climate Change and Energy 2007 (BCC 2007a) underlined the ambitious goals in "addressing climate change and peak oil" at the time. Key objectives defined by the Council's Climate Change and Energy Task Force were the reduction of greenhouse gas emissions by 50% and a carbon-neutral City Council by 2026:

> In 2026, Brisbane will be designed in response to the elements of our landscape, lifestyle and climate. […] We will have succeeded at retrofitting Brisbane as an energy-efficient, water-smart city. Residents' eco-friendly efforts will include local initiatives such as neighbourhood food gardens, tree plantings, rainwater tanks, grey water reuse and large-scale green technology projects, including roof gardens. We will have significantly reduced the need for air conditioning through these smart designs. (BCC 2006)

Next to policy support for sustainability in the residential sector, the BCC and the Queensland Government administration provided guidelines and incentives for greener commercial buildings. While the Plan for Action sets ambitious goals to reduce greenhouse gas emissions a few years before Vancouver introduced its Greenest City 2020 Action Plan (Chap. 6), climate change language and actions to achieve these goals particularly in the private residential sector have not followed through on the vision presented in the 2007 policy document.

7.3.3.2 The Commercial Building Sector

The City Council strongly supported developments of commercial buildings through cash incentives and reduced infrastructure charges (City Council representative, Bris03). Interviewees highlighted the political leadership role of the BCC during the

mid-2000s. The Council's support for Green Star certificates through incentives and reduced infrastructure fees was widely seen as an important catalyst and starting point for the adoption of green building principles in Brisbane. While there was no agreement amongst experts whether this support has had a positive effect on the development of office buildings in Brisbane, a green building boom in the commercial sector occurred in Brisbane's inner city in the mid-2000s. There was general agreement amongst interview respondents that the key driver for the green building take-off in Brisbane and also other Australian cities was the Green Star building rating and certification tool introduced by the Green Building Council of Australia (GBCA) (see Table 6.1). This non-profit association founded by green building experts, representatives of property and construction industry and government administration in 2002 certifies buildings and building-related designs on a voluntary basis. Experts highlighted the special role of the GBCA in sustainability transitions in the building sector.

> A lot of the activities have been driven through the Green Building Council, particularly in the commercial building and the retail sector. I think that is a really important piece of the puzzle in terms of how the industry decided to respond to the challenge in sustainability and climate, because effectively that body set up to be the industry's self-regulator. (Consultant, Bris10)

A number of green office building projects were realised by ambitious developers and investors. Between 2006 and 2008, 20 Green Star certifications were issued in Brisbane. This was the highest number of certifications compared to the other Australian metropolitan areas at that time (GBCA 2015) (see Fig. 7.5). A former representative of the GBCA (Bris20) explained that Brisbane had a leadership position as "there were more new green buildings in Brisbane than in any other city". Ambitious property developers and institutional investors built Green Star-certified office buildings in the CBD and Fortitude Valley, a central Brisbane suburb.

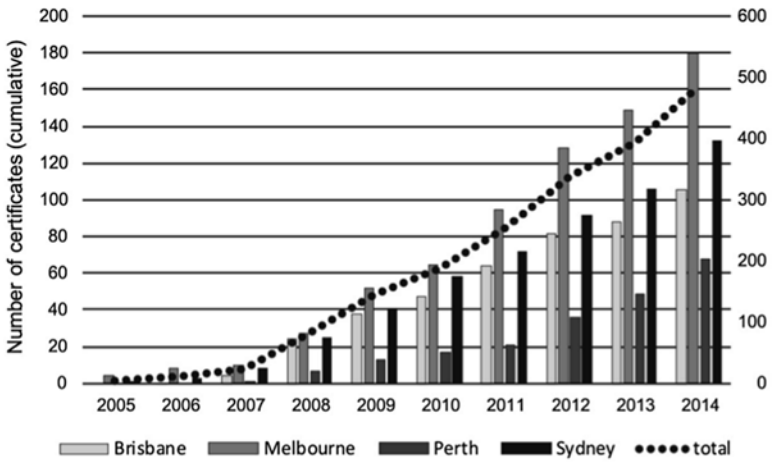

Fig. 7.5 Green Star certificates in Brisbane, Melbourne, Perth and Sydney between 2005 and 2014 (Own illustration; data source: GBCA 2016)

According to the interviewees and similar to arguments brought forward by respondents in Vancouver, the certification tool was an important catalyst for new pathways in Australia's building and construction sector, predominantly in the commercial building sector. The GBCA provides a wide range of rating schemes for different building types, such as office, multi-unit residential, healthcare and educational facilities, industrial buildings, retail centres as well as for neighbourhoods and whole communities (GBCA 2017b). The Green Star rating includes various building-related categories, such as energy, water, materials, transport and management. According to the points achieved per category, projects are certified as a four-, five- or six-star Green Star building. Since 2005, hundreds of certified green office buildings have been realised in Australian cities (GBCA 2016) where developers, institutional investors and public authorities apply for a Green Star certification for office building projects.

After a slow take-off during the first years with a small number of certifications, green building received more attention when the Property Council of Australia (PCA) introduced environmental parameters to their Guide to Office Building Quality (PCA 2006). PCA's property ratings, which are important for the value and the leasing of Australian office buildings, were linked to the GBCA rating tools for the first time in 2006 as argued by a number of respondents. Interviewees highlighted the sustainability parameters which were added to the PCA's Guide to Office Building Quality in 2006 and further improved in 2011. The guide, consisting of 60 parameters, has been used to classify office space into grades ranging from Premium to A, B, C or D Grade depending on the location. Four-star Green Star ratings became essential benchmarks for new Premium Grade buildings in the CBD and inner-city suburbs (PCA 2006) and were seen as an important tool to increase property value and returns on investment and linked to that reduce vacancies (Representative of the Property Council of Australia, Bris14).

The certifications led to an increased competition on the real-estate market and thus the construction of numerous greener building projects. Daylight usage, cross-ventilation, PV installations, co- or tri-generation systems, energy modelling systems, environmental friendly materials and water tanks are increasingly used in new high-rise office buildings. These innovative technological and building design aspects are becoming increasingly mainstream in new office buildings located in Australian inner-city areas. Sustainable buildings are also becoming more prestigious and are commonly utilised as central marketing tools to increase the building and rental values. Long-term strategic thinking of large institutional investors and developers are seen as important factors for this transition.

7.3.3.3 Brisbane Square: A Policy-Driven Demonstration Project

One of the first five-star Green Star-certified building projects in Brisbane, the Brisbane Square, was completed in late 2006 and certified in 2007. Of the building's 37 storeys, 23 have been leased to the BCC. The project was to demonstrate the Council's leadership position and the will to support and rent resource-efficient

buildings. The building includes over 50,000 m^2 of office space and features a number of innovative green building elements: high energy performance and monitoring system, blackwater sewer mining, heat rejection from the building's air-conditioning system to the river and usage of sustainable timber and other materials (GBCA 2006). A former employee of BCC stated that Brisbane Square was an important demonstration project, "an iconic building, the first green building. […] it was the one that really changed the main market" (Bris20). However, some building design elements and its sustainability performance also evoked criticism from experts and employees in the building. Blueprint concepts were conceptualised in the cooler climatic conditions and local contexts of Melbourne and Sydney. The adaptations of design to suite Brisbane's environment received criticism.

> If you look at Sydney. In Sydney Harbour they have been using harbour water cooling systems for years. […] But the situation is slightly different here on the Brisbane River [due to high amount of sediments]. So there have been things that were tried but that haven't worked out well. (Former Council Member, Bris20)

For instance, the building's cooling system which includes a cooling tower concept was shut down just after a short-term period of usage. Furthermore, the shading concept of the building was seen critically.

> The external sun shade systems don't do a lot. They are a really good porch for the crows that fly up here. The major heat load on the building is the end wall that faces the river because that is more sort of northwest to west. And that has got no sunshading at all. […] And a lot of people say it is a Melbourne building placed in Brisbane […] It doesn't respond necessarily to our climate that well. (Former BCC member, Bris01)

Statements like these describe the challenges and weight of demonstration project. They also highlight the need for local, context-specific solutions and learning by doing and experimentation in sustainability transition processes. A copy and paste of blueprints or transferable best practices are often not adequate (Fastenrath and Braun 2016). Learning processes in the commercial building sector followed through a number of Green Star-certified buildings in Brisbane. An interview partner (Consultant, Bris20) described that learning processes took place from project to project and between different partners. "What we've seen is that buildings are learning from each other". Furthermore, there is also general critique regarding the greening of the office building sector. Some interviewees and experts at the GreenRegio workshop debated if five- or six-star Green Star-rated buildings are necessarily greener than other buildings during operation. Interviewees argued that technologies applied in these high-tech buildings were not used properly and some investors had even switched off their systems (e.g. co- or tri-generation systems) after the certification processes.

7.3.4 Ruptures Through Policy Resistance: The 2010s

The support of green building in politics and the building and property industry lost momentum at the end of the 2000s. Interviewees, especially former Council employees, made clear that the prominent role of sustainable development and green

building within the Council changed after the City Council elections in 2008 when Campbell Newman was re-elected as Lord Major and the Liberals took control over the Council. The BCC's ambitious goal to become Australia's greenest city and discussions about climate change adaption strategies declined. Interviewees labelled these significant changes in political agenda setting in Brisbane as *flip-flop policy* that occurred at the local level and a few years later the state level. A City Council employee (Bris01) described these changes and the ongoing conflicts between economic and sustainability agenda setting as follows:

> I remember the Lord Mayor, […] he was really excited about this [climate change objective] and then the following year, the team just got cut, because they were too expensive and there were some other financial pressures. […] I mean this is the problem, sustainability in the industry and in the market, but also within council, has peaks and drops of being a key issue or being effectively a second-year issue. […] But if it came down to a situation where sustainability or economic development were competing, I suspect that sustainability would take a low position. (BCC employee, Bris01)

There was a broad consensus amongst interviewed experts that the changed agenda setting of sustainability at that time was strongly affected by the global financial crisis from 2007 to 2009 and the historical floods in January 2011 when city infrastructure was seriously damaged and caused high redevelopment costs. In the expert and stakeholder interviews, the significant policy changes, the global financial crisis and the floods were the most frequently mentioned barriers for further sustainability transitions in Brisbane's building sector. Four years later in 2012, Newman became Queensland's Premier Minister forming a majority government by the Liberal National Party. Policy objectives were concentrated on economic growth. The political agenda of sustainable development was largely neglected and "any momentum that was there under the former government had just been lost" (Bris25). One BCC member (Bris06) recalled that "before 2011 we had two or three years when sustainability was really high on the agenda, but somehow in 2011 the thinking and the priorities changed". One consultant remembered how programmes and incentives on the local and state level were stopped and employees in the field of sustainable development and environment became unemployed:

> At that time [mid 2000s], there was a lot of synergy going on between the Labor Government [at the state level] and the Brisbane City Council. Things were really boiling. But then those grants finished and the new government came in. […] The first thing they did when they moved in, they sacked anybody who had anything to do with environment. And they took all of the environmental requirements out of their contracts. (Bris07)

These comments describe the state government's anti-sustainability actions after the 2012 election. The Queensland Government stopped a number of programmes such as the ClimateSmart Home Service based on the argument of saving costs and taxpayers' money as "part of the government's plan to get this state back on track" (QLDGov 2012). The programme was conceptualised as a service for home owners to improve their energy efficiency. Qualified trade persons provided advice for energy and water savings during home visits. Concurrently, the state government's Office of Clean Energy which coordinated programmes in the field of renewable energy and energy efficiency was closed. Furthermore, the requirements for new

homes to include rainwater tanks and energy-efficient hot water systems were scrapped (QLDGov 2013). It is also worth noting that the leadership role in the greening of government buildings was abolished as the new political agenda was marked by a roll back of environmental and climate change policies. The policy goal of greening publicly owned or rented buildings and the application of Green Star certifications have been widely neglected by the Newman Queensland Government but also by the City Council. A City Council employee (Bris06) similarly described policy roll back at the municipal scale in respect to city buildings where best practice was not prescribed and measured but rather "very open, vague, non-committal".

Similarly, a Brisbane-based expert (Bris11) stated that green building is "almost back to where we have been in the mid 1990s in terms of regulatory or policy frameworks for driving things like energy and water sustainability". Also the GBCA critically commented on the disruptive policy paths in Queensland, especially the dismantling of the Green Door Policy, which was introduced to fast track sustainable development approvals by the former labour government (GBCA 2015). Despite the strong roll back of policy support, experts agreed that there are significant changes towards increased resource efficiency in Brisbane's commercial building sector in the CBD and inner-city districts. It is widely accepted that green office buildings became more and more common in Brisbane, demonstrated through the increasing number of Green Star-certified commercial buildings constructed. Therefore, a number of interviewees argued that these greening processes in the commercial building sector were strongly market- and industry-driven and the developments in Brisbane's CBD would have happened without policy support.

7.3.4.1 Political and Industry Resistance in the Residential Building Sector

As a result of the significant policy changes on the local and state government levels in the early 2010s, green building transitions dynamics lost momentum, especially in the residential building sector. While in the 1990s, Brisbane was described by some as leading green building in Australia, there was a common understanding amongst experts and stakeholders that Brisbane's residential market is now lagging behind the sustainability transition processes in the commercial sector. In addition to the policy-makers, property developers and professional associations resist against sustainability transitions. An official of the leading property industry organisation stated (Bris14): "I think there's a longer path to travel in the residential space". Also a Brisbane architect (Bris23) agreed: "We're about 30 years behind in terms of the path".

New and existing residential buildings in Brisbane still do not achieve possible sustainability outcomes in terms of building design, orientation, materials (non-toxic and recycling), usage of renewable energy and water efficiency. Experts and key stakeholders in the residential sector agreed that new homes often do not consider basic sustainable building and construction principles. In particular, the

Fig. 7.6 A typical new, detached house in Brisbane 2016 (Photo: Sebastian Fastenrath)

residential sector was seen to fail to experiment and implement innovations in particular in response to the local climatic conditions and energy savings (see Fig. 7.6).

These include a number of critical building aspects in the residential building sector such as inappropriate building design for the subtropical climate (e.g. building shape and orientation, internal layout, natural ventilation and shading) and lack of the usage of environmental friendly and healthy materials and technologies (e.g. insulation, cooling/heating systems and integration of renewable energies). Even though there were demonstration projects such as the green display village in Springfield Lakes and general interest in the building and property industry during the 2000s, a market uptake for greener homes did not occur. Several reasons for the resistance in the residential sector were identified during the GreenRegio project's kick-off workshop and through personal interviews with a wide range of experts and stakeholders in Brisbane:

- Policy discontinuity expressed in significant policy changes after government changes and roll back and lack of policy support at the local and state level
- Short-term thinking of different industry actors (builders, developers) and policy-makers including additional costs for green building features
- Inappropriate and insufficient regulation for energy efficiency (building codes)
- General lack of public awareness of environmental and sustainability issues
- Lack of skills in building and construction (educational challenges)
- Lack of building materials including availability of certain products such as double-glazed windows

The most mentioned barrier for green building in Brisbane's residential building sector was the lack of policy support and policy continuity. The significant policy shifts in support of sustainability transitions in the building sector after government changes, especially on the state level, were predominantly seen critically. Important achievements such as mandatory building features, like water tanks or solar hot water systems, were analysed as important transitional steps towards increased resource efficiency in the residential building sector. There was agreement amongst experts that the National Construction Code and its state variation, the Queensland Development Code, as well as urban planning approaches on the local and state level are inappropriate in coping with green and subtropical building design, including orientation of buildings, materials and technological features. The weak building regulations in terms of resource efficiency for new homes, especially in the large master-planned communities, were also seen as problematic. A representative of a property industry organisation (Bris13) argued that "if all potential house buyers had a requirement demanding energy and water efficiencies and passive solar design, then obviously the industry would respond to that, but that is just not the case".

Next to institutional barriers, the role of key industry actors such as large property developers and building company were mentioned and can be interpreted as transition detractors (Fastenrath and Braun 2016) in this context. Conservative- and short-term-oriented business models, missing sustainable responsibility and strong lobby work, were often seen as significant barriers. Actors were seen as resistant to change and Brisbane itself described as "a country town with high-rises" (Bris06). Experts argued that large property developers could influence sustainability transitions during the planning stage (e.g. through smaller lots, orientation of lots and provision of infrastructure) and through subdivision of land. However, the developers' influence in the building design is limited. The builders, often small- or medium-sized enterprises, decide about the building designs, building features and materials. A representative of a builder professional organisation made clear that the builder companies do not want to run any risk through early adoption:

> It is not our role to be the first trying to tell [the home buyers] […] we are only going to build [green] and it is going to cost you more, because it is greener. They will go and buy an established home. (Bris16)

The additional costs for a greener home compared to a conventional home were often named as barriers to sustainability transitions. Experts agreed that home buyers in Brisbane are usually not interested in green building. The demand for resource-efficient homes in master-planned communities is low. Home buyers tend to look for cheaper conventional buildings and are not interested in mid- or long-term investments in green design and technology features. While some interviewees argued that transitions in the residential sector should be driven by market mechanisms, a large share of experts assumed that significant changes in the residential building market should be gained through a combination of policy regulation and the support of different industry actors.

> All the stakeholders in the industry have a part to play. It's not good to just wait for the consumers to demand something. […] It is hard enough to convince someone that climate change is happening, so it has to be a combination of government, of the developers, the builders, the suppliers. (Property industry representative, Bris15)

A high official of the key property industry organisation (Bris14) predicted an uptake of greener homes driven by GBCA certification: "The journey is starting now with the residential sort of things. […] GBCA set up the Green Star for residential communities". Indeed, in 2015 the GBCA amended their rating categories to include a newly developed certificate for communities. This development was seen as an important step towards industry-driven sustainability transitions in the residential sphere. A representative of a property industry organisation (Bris09) confirmed the impression of other interviewees that transitions in the master-planned community housing market is slowly taking off: "It seems like developers want to leave a legacy of good buildings and that sustainability is slowly encroaching on the very definition of what a good building is". These observations reflect the interest of large property developer companies, such as Stockland and Lendlease, in the Green Star community rating for their current projects. Stockland's Aura development at the Sunshine Coast, located north of Brisbane, has been awarded with a six-star rating for their environmental and social considerations in the master plan (GBCA 2017a). Lendlease applied for a Green Star community certification for their new development Yarrabilba in Logan City, 45 km south of Brisbane (Lendlease 2017b). To what extent the recent interest and uptake reflects increased environmental concern or whether it is driven by new market opportunities remains unclear.

7.4 Innovative Approaches in the Multi-storey Residential Building Sector

Despite a lack of resource-efficient building approaches and continual resistance in Brisbane's residential building sector, a number of innovative green affordable building projects have been completed since 2010. Two multi-storey residential projects were identified which are driven by not-for-profit housing providers that bring together innovative resource-efficient and environmental friendly building approaches and social or affordable housing.

7.4.1 The Green Square: Resource-Efficient and Affordable Housing

An innovative green multi-storey residential building project is the Green Square building, which has been developed on the site of an old Brisbane Council Depot in the suburb of Fortitude Valley. The 10-storey building, designed by the Australian

Fig. 7.7 The Green Square open building design (Photo: Sebastian Fastenrath)

renowned architect firm Cox Rayner, provides 80-studio or 1-bedroom apartments and two floors of office space which are used by the City Council. Since its completion in 2010, Green Square has provided affordable and social housing. The building includes social services for single and couple households who are homeless or at risk of being homeless. The building's innovative seven-level interior atrium (Fig. 7.7) provides communal space containing cooking and laundry facilities, which offer the residents a choice between interaction with others and privacy. The building design applies simple and cost-efficient green building approaches such as a focus on cross-ventilation and the installation of water tanks and efficient appliances in the apartments. Furthermore, the green wall in the atrium helps to cool the building in summer by improving ventilation and light penetration. The building achieved a six-star energy rating because of its low operating costs. In 2013 Green Square received the Australian Institute of Architects National Award for using

sustainable architecture as well as the EnviroDevelopment certification from the Urban Development Institute of Australia due to significantly reduced usage of water and greenhouse gas emissions (BHC 2017; UDIA 2017).

Green Square was developed by the Brisbane Housing Company (BHC), a non-governmental organisation with a non-profit approach. The main aim of BHC is the development of affordable housing that connects strongly to sustainable development. More than 1500 residential dwellings have been developed since 2002 with financial support from the Commonwealth government, state government and Brisbane City Council, in addition to selling to investors and owner occupiers and joint venture agreements (BHC 2015, 2016).

7.4.2 Brisbane Common Ground: A Holistic Sustainability Approach

A more recently developed and increasingly recognised pioneer project is Brisbane Common Ground which similarly links resource-efficient building approaches and social inclusion. The project, developed in the inner-city suburb South Brisbane in 2012, demonstrates an innovative holistic view of sustainable housing. The building provides 146 residential units over 14 storeys for homeless people or those with low income (Fig. 7.8). The rent is set at around 30% of the tenants' income. Social workers, the building's own medical unit and volunteers from the South Brisbane neighbourhood support the tenants. In addition to social integration, the project responds to environmental sustainable building principles, in terms of energy and water use. Similarly to the Green Square, the building is designed for Brisbane's subtropical climate. The orientation, open layout and cross-ventilation system reduce the need for air conditioning in the apartments. The PV installation on the roof also helps to reduce energy consumption. Water tanks in the basement of the building hold 130,000 L of rainwater which is used in the gardens, toilets and laundries (Parsell et al. 2015; BCG 2017).

Green Square and Brisbane Common Ground are two innovative building approaches that are characterised by new actor constellations and demonstrate how green building can go hand in hand with cost-effective affordable housing and other social sustainability goals. The projects show that the non-commercial approach and the support of a wide range of private and public sectors can play an important role as transition agents (Fastenrath and Braun 2016) and stepping stones for innovative sustainability transition in the housing market. Furthermore and due to the non-profit business concept, this approach allows for future adjustments to any errors or mistakes that occur with design or implementation. The importance of local learning by doing processes in the building and construction sector was similarly evident in Freiburg as outlined in Chap. 5 (in more detail also in Fastenrath and Braun 2016).

Fig. 7.8 The Common Ground Brisbane (Photo: Sebastian Fastenrath)

7.5 Conclusion

This chapter on the introduction of green building in Brisbane gives insights into the challenges and barriers in urban green building transitions. The analysis demonstrates how the local and regional contextualisation can evoke ambivalent and distracted sustainability transition pathways in the building and construction sector. Over the last 15 years, changes towards increased greener building and construction followed a non-linear logic. Changing policy and industry support evoke divergent developments. While significant shifts towards increased resource efficiency in the commercial building sector can be identified in Brisbane, the residential market is still lagging behind. Transitions in the commercial sector have been driven predominantly by property market mechanisms and industry actors focusing on long-term investments. Green building certification introduced by the GBCA played a crucial role in this process.

The delay and disruptions of trajectories in the residential building field may be interpreted as the result of repetitive regime resistance (Geels 2014) against greener building practices. A general lack of awareness in environmental topics of home buyers, an anti-sustainability ideology driven by the Liberal National Party in Queensland, the lack of will for change and innovation in the building and construction industry and inadequate building regulation were identified as barriers. While policy-makers and stakeholders in the building and construction industry widely agree that shifts in the residential building sector are necessary, policy-makers and industry actors (developers, builders, craftsmen and contractors) resist greener forms of building and planning approaches. The main argument on the industry actor side is the limited demand for green homes due to higher costs for greener building solutions. Policy-makers, especially at the more powerful state level, argue that transitions in the building sector should not be driven by building regulation. As a result, there is a void which can be described as an industry-policy lock-in mechanism—both sides evaluate the other side as the responsible one. Recent developments towards greener building approaches in the master-planned community sector indicate first actions on the industry side even though motives were not clear based on the research conducted. All stakeholders agree that the next predicted two million residents in Brisbane and the surrounding region of SEQ have to be accommodated in affordable but also more sustainable homes.

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Chapter 8
Luxembourg: A Policy-Led Approach Caught Between Green Growth and Affordable Housing

Bérénice Preller

Abstract Luxembourg, known for its economic wealth linked to the finance industry, has shown significant efforts to transform its building sector. This chapter traces the emergence of sustainable building in Luxembourg since the late 1990s. Green building in Luxembourg is strongly driven by progressive government regulations and policies that illustrate different understandings of and approaches to greening. The chapter distinguishes between two policy approaches: (1) green growth and (2) social housing and urban sustainability. The first consists of a sustainability perspective that is based on the compatibility of environmental and economic objectives. During the 2000s, green building was primarily understood through energy efficiency to be achieved at the scale of individual buildings. This focus was broadened over time towards eco-technologies more generally that are promoted as strategy to further diversify and to position Luxembourg's economy internationally. The second, less dominant approach moves beyond technological fixes and the scale of individual buildings towards more holistic approaches to urban sustainability through social housing. While government initiatives and (partly) the private sector's efforts have gained considerable momentum, public participation and civic engagement in green building are rather ephemeral, compared to other city regions.

8.1 Sustainable Building in an Economically Dynamic Small State: Opportunities and Pressures

The Grand Duchy of Luxembourg (in the following referred to as Luxembourg), a small state of 2586 km^2, is primarily known for its exceptional prosperity and economic dynamism (Fig. 8.1). This is mainly induced by the state-led rise of its capital, Luxembourg City, as a specialised financial centre of European and international importance in the 1980s (Walther et al. 2011; Hesse 2016; OECD 2015). Since the early 2000s though, the government has articulated a growth strategy to address its monolithic economy. One key development target of that strategy is eco-technologies,

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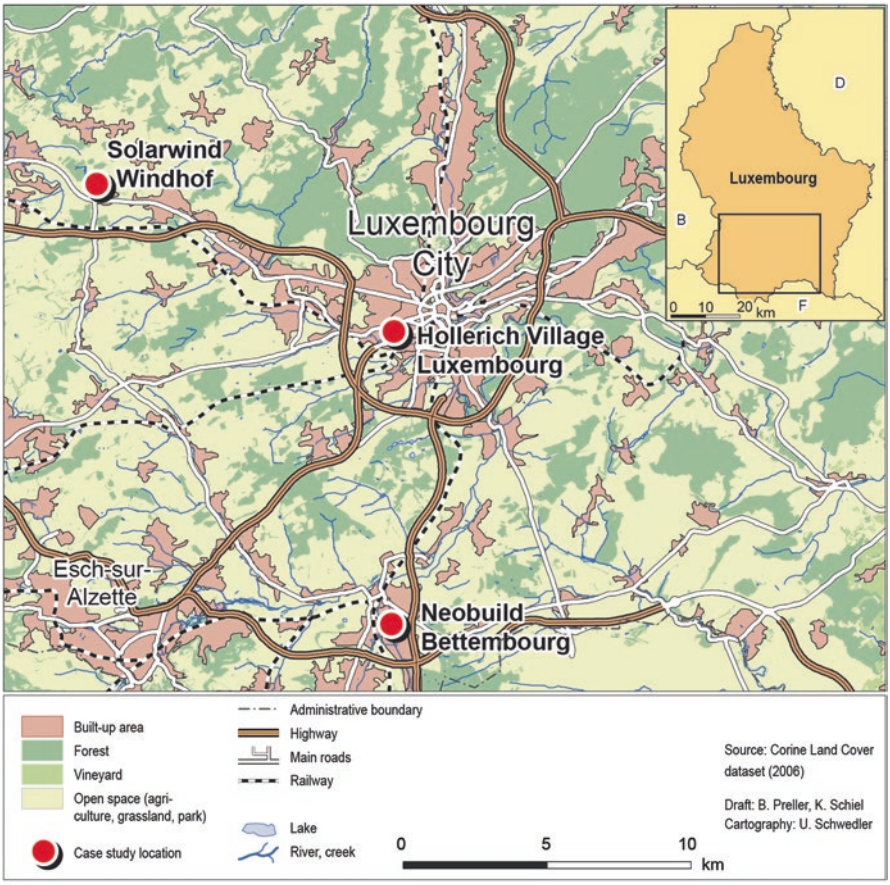

Fig. 8.1 Case study locations in Luxembourg (Cartography: Ulrike Schwedler)

with a particular focus on green building (EcoInnovation Cluster 2017). In the wake of the financial and related service sector boom, the country has faced unprecedented growth in population and economic functions, leading to almost a doubling of the built-up area between 1990 and 2010 (Chilla and Schulz 2015: 514–515; STATEC 2017). These intense construction activities of office and residential buildings have positioned the building sector just behind the financial sector in terms of employment, making it a key contributor to the country's economy (STATEC 2016b). Luxembourg further has one of the highest GDP per capita amongst OECD countries (OECD 2015), and its small state political structures are characterised by short decision paths and a reduced number of government levels (Lorig and Hirsch 2008; Chilla and Schulz 2012). Together these particularities provide a positive financial and political context to realise the country's ambitions in positioning green building and eco-technologies as a key economic sector both locally and internationally.

Luxembourg's exceptional growth also poses challenges in terms of liveability most notably with regard to shortages and affordability of housing as the real-estate market has been unable to keep up with the steady demand by the economic and residential sectors. The country's population has almost doubled since 1980 to reach 576,000 in 2016 of which 47% are foreigners (STATEC 2016b). Inhabitants are projected to reach one million in 2050 (Menelaos 2015). The situation is further exacerbated by a tendency to prioritise office space over housing and speculative tendencies partly attributed to a high share of private land ownership. The combination of these factors has led to an explosion of housing prices and rents (Hesse 2016; Hesse and Christmann 2016), reminiscent of issues more broadly documented in the critical literature on affordability in eco-/green cities (e.g. Dale and Newman 2009; Caprotti 2014). Luxembourg's residential patterns further challenge sustainable urbanism and living practices: at country level the privately owned single-family home dominates amongst the dwelling types making up 83.5% of the housing in 2011, even though the construction of apartments has been steadily on the rise since 1990 (Heinz et al. 2013a) especially in the larger urban area of the capital. Average housing surface approximates to 130 m^2 with an average of 64.4 m^2 per person and is amongst the highest in the EU (Heinz et al. 2013b). Similarly, car ownership rates of 661 for 1000 inhabitants (2015) are amongst the highest within the European Union. Even though the rate can be partly attributed to large company car fleets for cross-border commuters (Eurostat 2017), residents strongly privilege the automobile, even for short trip distances under one kilometre within the agglomeration of Luxembourg City with good public transportation in place (Schulz and Chilla 2011: 19).

This chapter explores how Luxembourg's specific conditions including the combination of political voluntarism towards green growth and a particular socio-economic context have shaped the country's approach to green building. Within this context, green building in Luxembourg can be described as shaped by two coexisting and not necessarily reconcilable agendas. These are consistent with Moore and Rydin's observation of policy networks promoting sustainable construction in the United Kingdom and at the European level: (1) a "construction technology agenda", supported by the industry and articulated around technical innovation and economics, and (2) "[an] urban sustainability planning agenda" which is "much more general, process-oriented and aspirational in tone" (Moore and Rydin 2008: 240). To better understand the constitution of these two agendas, the chapter takes a primarily historical perspective. Throughout the chapter, the argument put forward will be illustrated with case studies of building projects (see Fig. 8.1). As detailed in Sect. 4.3.3 and similar to the other regions, the in-depth analysis of these micro case studies plays a pivotal role in understanding how green building is approached and transposed in Luxembourg. The analytical focus lies here on the agents involved in the building process (public and private stakeholders, building owners and firms involved in the construction) but also on the rationales presented to justify the constructions as they are reflected in interviews and textual resources like promotional material and newspapers. While green building projects are prevalent across the whole country, the most emblematic ones addressed in this chapter still belong to

the larger catchment area of Luxembourg City, mostly due to the exceptional dynamism of the capital's real-estate market.

The chapter unfolds as follows. The next section (Sect. 8.2) outlines how key legislative and state-led policy interventions have initially addressed sustainable building through a sectoral lens and framed it mainly as an energy efficiency topic. Section 8.3 then analyses how this has been complemented by a decisive political prioritisation of green economy themes, discussing underlying rationales. Finally, Sect. 8.4 focuses on politically less prominent aspects of the debate as they relate to housing affordability and more comprehensive approaches of urban planning and densification. The conclusion (Sect. 8.5) draws on Dryzek's (2013) analytical tool of environmental discourses to critically assess the transformative scope of a transition towards green building in Luxembourg.

In contrast to the previous three case study chapters which have focused on cities and their urban agglomerations, this chapter uses the national level as (urban) scale of analysis. Luxembourg's sheer size and its small state political institutions both provide arguments in favour of an analysis at the national level. The nation state is indeed the main decision-making level and as such a central player when it comes to green building regulation and policies. This is obvious when green building is part of a national economic diversification strategy but also when the urban planning dimension of the topic comes to play. The aforementioned development pressures have indeed resulted in efforts towards more coherent and coordinated spatial and sectoral planning at the national level, despite a historical tradition of municipal autonomy (Chilla and Schulz 2011, 2012; Affolderbach and Carr 2016; Hesse 2016). The overarching goal setting and regulatory powers with regard to spatial development are thus orchestrated by the central government and decisively set under the lead normative concept of sustainability (Carr 2011: 5, 2014: 1827). Municipalities remain in charge of land use plans within their boundaries and are further involved through different consultation mechanisms (Eser and Scholtes 2008: 295–297). The particular case of Luxembourg City does not contradict this picture despite the city's economic dominance and its undisputed status as a major urban centre of the country counting approximately one fifth of the inhabitants (STATEC 2016b). As has been shown by Hesse (2016), it is admittedly a micro-metropolis providing specialised services to the international service industry. But this development is to be credited to and is still mainly orchestrated by the national level. As such, Luxembourg is essentially a city-state formation. Consequently, most of the economic and non-governmental actors involved in green building in Luxembourg are also mainly organised and active at the national scale.

The chapter is based on primary information gathered during an interactive stakeholder workshop involving 27 green building experts in 2014 and 19 personal interviews conducted in 2014 and 2015 with representatives from the public, private and non-governmental sector involved in green building in Luxembourg. It is complemented by an in-depth review of relevant policy documents and legislative texts.

8.2 Energy Performance Requirements: A Trigger for Sustainable Building Approaches

> At some point it became clear to the Luxemburgish government that the only thing they could politically do in order to reach the specifications from Brussels is energy efficiency. […] In Luxembourg [energy efficiency] seems to be a *low hanging fruit* [English in original] […]. Can you believe this?! That this aspect is the easiest for Luxembourg to achieve? (Consultant, Lux05)

Luxembourg has been involved in and ratified most of the international treaties and events on climate change. As such, the country is committed to fulfil agreed targets to reduce greenhouse gas emissions (Carr 2011: 9). Similarly, European strategies like the Lisbon Agenda and its successor Europe 2020 have also contributed to shape Luxembourg's approach to sustainability through notions of sustainable growth and resource efficiency and security. Sustainable building needs to be understood in this context. Figure 8.2 provides a timeline of the major relevant European and national regulations as well as national events and initiatives. The building sector, together with the transport sector, has been identified as one of the areas with the highest potential to reach the country's energy efficiency objectives and thus climate change engagements.[1] The third National Energy Efficiency Action Plan foresees half of the projected energy savings until 2020 to be gained in buildings (Ministère de l'Economie 2014a: 8), an objective that takes into account Luxembourg's strong construction activity. Metric targets for CO_2 reductions, energy efficiency and related policy actions for new and retrofitted buildings are further articulated in several key policy programmes (Fig. 8.2), ranging from the first and second National Climate Action Plan (Ministère de l'Environnement 2006; Ministère du Développement Durable et des Infrastructures 2013) and the Action Plan for Renewables (Ministère de l'Economie et du Commerce extérieur 2010) to the National Plan for Intelligent, Sustainable and Inclusive Growth—Luxembourg 2020 (Luxembourg 2017). Even the coalition agreement of the 2013 newly elected government addresses the topic in several subsections, underlying its political prominence (Programme gouvernemental 2013).

Sustainability in the built environment is accordingly mainly articulated through energy questions, a focus frequently seen as too narrow by interview respondents. The focus is unsurprising as the topic has been brought to salience in the wake of the transposition of the European Energy Performance of Buildings directives in the mid-2000s which emerged as a chronological narrative from most interviews. Luxembourg has passed a first heat insulation regulation in 1995 (Gouvernement du Grand-Duché de Luxembourg 1995) in order to limit energy losses through building envelopes. Further legislative steps to address the energy performance of housing and commercial buildings more comprehensively were only achieved in 2007 (Gouvernement du Grand-Duché de Luxembourg 2007) and 2010

[1] When considering final energy consumption shares across sectors, the bulk goes to the transport sector, followed by industry, households and the service sector (STATEC 2016a). Buildings are thus considered as a key area for action due to their cross-sectoral relevance.

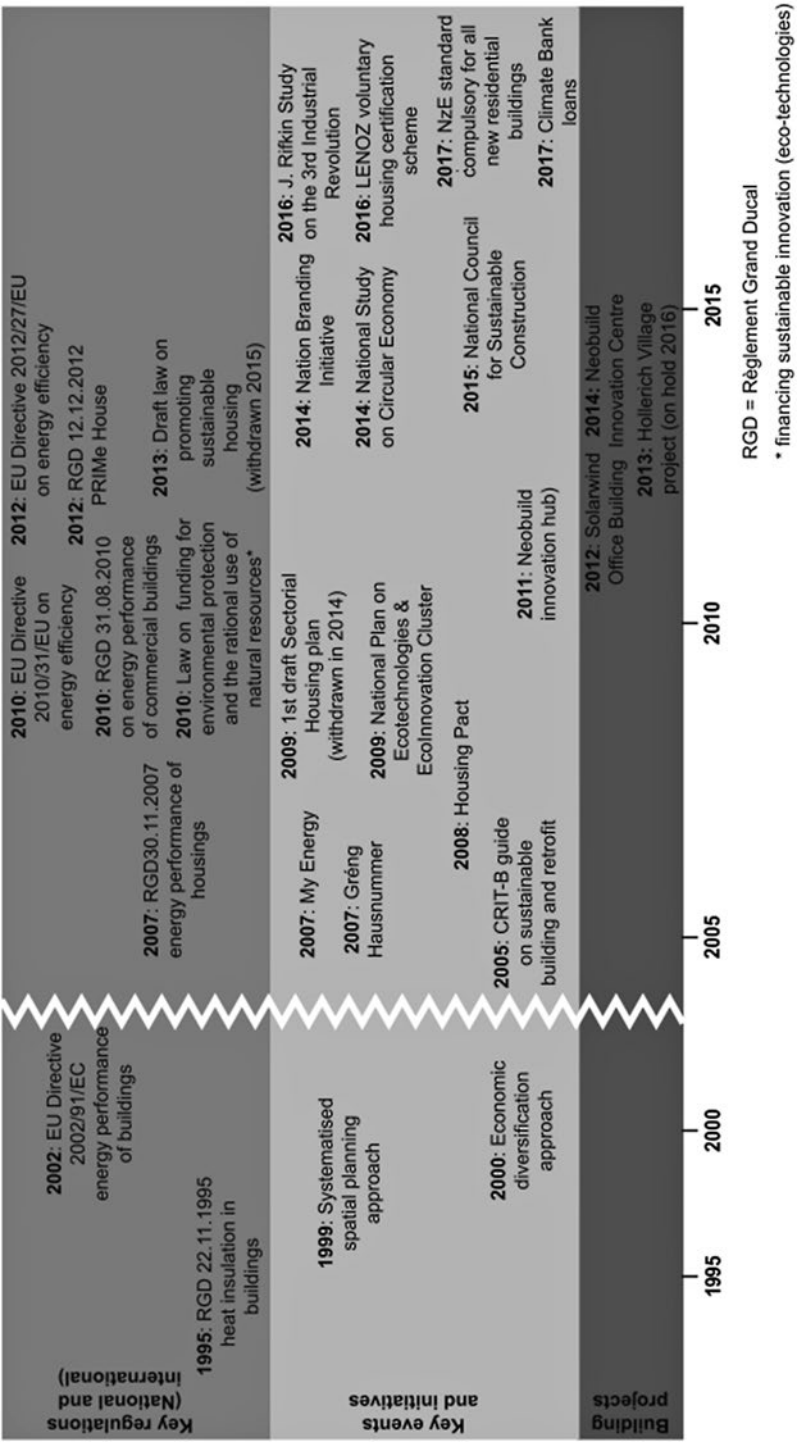

Fig. 8.2 Timeline events in Luxembourg including relevant EU initiatives (Illustration: Ulrike Schwedler)

(Gouvernement du Grand-Duché de Luxembourg 2010b), respectively. Both pieces of regulation were derived from the European directive 2002/91/EC (Parliament and Council of the European Union 2002) and have later been revised in response to the follow-up directives 2010/31/EU (European Parliament 2010) as well as 2012/27/EU (European Parliament 2012) on energy efficiency and retrofit. Through the relatively late implementation of the 2002 European directive, the Luxembourgish Ministry of Economy which is in charge of energy questions has had the time and opportunity to learn from other European countries which has spurred its ambition to do well (Government representative, Lux06). While the European directive 2010/31/EU requires a nearly zero-energy standard for all new residential buildings from 2020 onwards, Luxembourg has set the goal to reach this target as early as 2017. In line with the European directives, the Luxembourgish regulation mainly addresses technical dimensions of energy consumption in new and retrofitted buildings including quantified energy requirement targets, the set-up of compulsory energy performance certificates and the corresponding detailed calculation methods.

The explanatory statements in the parliamentary records for both bylaws provide a clear example of this energy-related understanding of green building. Stated rationales range from addressing energy dependency and security which have a negative impact for the economy, international climate change commitments of the Kyoto Protocol and positive impacts of energy-efficient building technologies for employment (Chambre des députés 2006, 2009). The focus on employment is particularly salient, illustrating both the key economic role attributed to the construction industry and a trust in interventions on the production side for a smooth and effective implementation of the regulative obligations. This has been clearly stated by one interviewed public employee when discussing rationales for training initiatives:

> Of course we know that if we inform and target only the final consumer, we won't have reached much. Because […] in the ideal case, we would have managed to raise awareness amongst a large number of final consumers [but] if the market can't answer the demand that we would like to create or that we would like to help support, this is strongly counter-productive. That's why we have discovered for ourselves other important target groups: [...] of course all those involved in planning and building processes, that is to say architects, craftsmen, engineers, energy advisers and then for the implementation all the craftsmen's firms. (Lux13)

The coalition programme of the 2013 newly elected government composed of social democrats, greens and liberals set the tone even more clearly:

> The housing sector represents a considerable source for the reduction of energy consumption, as much through the construction of new buildings as through retrofitting the existing stock. The development of capabilities in that domain is a priority in order to transform the transition towards more energy efficient housing and commercial buildings for economic growth (Programme Gouvernemental 2013: 61, translated from French)

Indeed, a study jointly conducted by the national energy agency (My Energy), the professional chambers and the building sector's main business association anticipates that by 2020 more than 8000 new jobs will be created as a result of the new energy standards (Myenergy et al. 2013: 6). A high level of turnover within the sector and the fact that most workers are immigrants or cross-border workers with very

diverse training backgrounds make the provision of adequate training and capacity building even more essential for success. The large-scale LuxBuild 2020 initiative, a European co-funded consortium of the same three actors, seeks to prepare blue-collar workers for the 2017 deadline. It has structured existing training offers around a yearly evaluation of needs, including a monitoring of technological advances. Complementary technical but also transferable skills courses are offered to building professions at large to ensure the passive standards are effectively delivered on construction sites (Myenergy 2017).

To increase the effect of compulsory regulations, user-oriented policy instruments have also been streamlined. Sustainable commercial building developments and retrofits can receive financial support under the 2010 law encouraging innovation through the use of eco-technologies and sustainable resource management (Gouvernement du Grand-Duché de Luxembourg 2010a). Similarly, previously existing public funding for new housing construction and retrofits (Prime House) has been revised significantly in 2012 and is now based on energy performance certificates. Accordingly, funding is only available in combination with energy efficiency measures and renewable energy measures (Gouvernment du Grand-Duché de Luxembourg 2012) and has become progressively more stringent to be ceased and replaced by other sustainability criteria for new constructions by the end of 2017. Further policy measures include the transformation of the national energy agency in 2007 that was split into two organisations, My Energy and Energie Agence. My Energy has the main tasks of raising public awareness and providing advice on renewables and energy efficiency. Sustainable building and housing have been explicitly added to its responsibilities since 2013, and one of the organisation's biggest successes is a yearly fair providing households with hands-on access to resource-efficient building technologies and expertise.

Respondents generally agreed that this set of public interventions has proven quite successful in anticipating and preparing the construction sector and consumers for the 2017 deadline in achieving energy efficiency. One private sector representative (Lux07) argued that the energy efficiency box has been ticked as energy efficiency has become "the norm […], of course there are still some exceptions but globally everyone can live with it [the energy performance certificate]". But this large-scale adoption was also linked to resistance, as several respondents recalled an initial reluctance amongst the industry, which consists mainly of small- and medium-sized enterprises (SMEs). Compliance with the regulatory changes was indeed first perceived as burdensome, time constraining and costly that averted human resources from the daily business. Acceptance only grew once the technical feasibility and especially the economic advantages became tangible and visible, hence encouraging more actors to want their share of the cake:

> You have the pioneer who starts and builds a residence on the left side of Haut-Cents [neighbourhood in Luxembourg-City] with an A-class, while the one on the right side does it with a B-class. And the one doing it in the B-class suddenly realises that the one doing it in A cannot only sell with a higher price, but that in addition, there are customers ready to pay that price. […] So you have a realisation […] amongst building companies that energy performance is something tangible […] that can be grasped in monetary terms. (Private sector representative, Lux01)

> […] I think people said: 'it's technically feasible!' That was by the way the goal of the exercise, doing a demo building. 'It's possible.' And in the aftermath, it led to a certain form of…de-dramatization, if you wish. (Business association employee, Lux07)

Even though compulsory changes seem to have been accepted and incorporated into the daily construction business, several interviewees pointed towards a persisting reluctance to change across the business community. This became particularly clear in the shared feeling amongst sector representatives that the sector was already facing enough challenges responding to energy efficiency targets. Having to address sustainable construction and green building in a broader sense that considered, for example, alternative design, building materials and new actor constellations were described as a further burden:

> I remember a meeting of the Sustainable Building Council where the representative of the professional chamber said very clearly: 'That's not on top of the list amongst craftsmen, the sustainable building topic. For them to properly manage energy efficiency, that is at the top.' (Public employee, Lux13)

> And that's what stroke me within the last years. That is to say how much the concept of sustainable building has become a limiting concept. […] In sum, it's the additional requirements that will apply to buildings from the moment passive buildings will be compulsory. (Architect, Lux15 2015)

In sum, sustainable buildings, here understood as energy-efficient buildings, are not the objective per se but means to an end within a structured causal chain beginning with quantified carbon reduction targets. These objectives are presented as achievable following calculation of energy efficiency improvements, which in turn are to be attained through technological enhancements in buildings brought forward by compulsory bylaws and adequate training and expertise of blue-collar workers. Following that line of argumentation, sustainable building appears to be realistically achievable as it is a predominantly technical challenge. This culminates in a "fabric-first" approach (Walker et al. 2015: 500) where the focus lies heavily on addressing single buildings and leads to very similar realisations (see Fig. 8.3), especially in housing, through an almost standardised repetition of proven technological solutions and interventions on the built form, as clearly expressed in the following quote:

> There has really been a cross-sectional and vertical mobilisation within the whole production chain, but on an energetic objective, with a quantified energy performance objective that has been prepared by the energy performance certificate […], that pushes for increasing requirements in terms of energy performance, and hence a building system that repeats itself in each and every building. You know it by now: triple glazing, strong insulation, controlled mechanical ventilation, all the concepts related to passive building. (Architect, Lux15)

Walker et al. (2015) presented similar findings in their review of the mainstreaming of zero carbon homes in the United Kingdom using the concept of reproducing normality through technical solutions on the building fabric that avert from eventually more extensive changes in lifestyle. Likewise, Souami (2009) in an analysis of perceptions of relevant energy territories in sustainable neighbourhoods noted how representations of energy spaces in such projects put forward precise and

Fig. 8.3 A typical A energy class residence in Belvaux, Luxembourg (Photo: Bérénice Preller)

simplified boundaries—in the case of Luxembourg, the individual building—rendering invisible the interdependencies of energy consumption questions. He attributes this to an analytical bookkeeping logic per territorial units which is necessary to build legitimacy for the technical realisations aiming at energetic quality within each perimeter (Souami 2009: 77), hence highlighting again the link between technical solutions and metrics at stake in energy efficiency approaches.

8.3 Green Building as Economic Diversification Strategy

The legitimation for green building around carbon commitments and energy performance objectives fits with the general policy trends towards carbon control (While et al. 2010). In Luxembourg, that logic is pursued even further through the voluntary positioning of green building as a strategic area for economic activity. As illustrated in a programmatic statement from the 2013 governmental coalition agreement, carbon reduction logics in Luxembourg are further articulated with development opportunities for an eco-building sector, thus tying energy and climate change objectives to economic growth:

> The government aims towards a convergence between policies on energy and the environment on the one hand and economic diversification on the other hand. Eco-technologies encompass technologies aiming towards a reduction of the energy and resource consumption as well as the protection of the environment.

> The government will put particular emphasis on the topic of eco-building, sustainable mobility and circular economy. In order to support the development of the eco-building sector, competence centres […] will reinforce research and innovation as well as bring the actors together. A concerted approach of actors from the sustainable construction sector will be ensured through the setting up of a National Council for Sustainable Construction (CNCD). SMEs will be better supported through a facilitated access to innovation and research, the *branding* of the sector, the realisation of lighthouse projects and a facilitated entry of national actors on the Greater Region[2] market. (Programme Gouvernemental 2013)

This strategy provides a prime example of a technocentric, ecological modernisation approach that is being increasingly criticised within the green economy literature. Even though this agenda is still very diverse in its implementation, common elements are the belief of a compatibility between environment and economy, the key role ascribed to technological innovation and progress in general, as well as an active involvement of the private sector (Kenis and Lievens 2015: 4–5; Bina 2013). Critical contributions in the literature have raised questions as to whether such expressions of the green economy or green growth agenda can actually be transformational or whether they simply reconstitute the dominant socio-economic paradigm under a new label (While et al. 2004; Bina 2013; Whitehead 2013; Caprotti and Bailey 2014; Kenis and Lievens 2015; Jones et al. 2016).

The question is particularly relevant to Luxembourg where sustainable building is subordinate to and legitimised by a perpetuation of the overarching goal of continued socio-economic affluence. While there is general consensus that the development of the country's financial industry has brought a high standard of living, the dependence of the economy on the sector is seen as critical in a context of global economic competition (Ministère de l'Economie et du Commerce extérieur 2012). To address this challenge, the government and more specifically the Ministry of Economy has, since 2000, driven a strategy of economic diversification and sought to attract alternative investment. Amongst other measures, a national cluster strategy was set up in 2004 under the lead of the national innovation agency Luxinnovation with the objective to support development and innovation in strategic high value-added sectors. Since the publication of an action plan in 2009, eco-technologies are one of the identified priorities, in line with developments at the European level. The EcoInnovation Cluster, created the same year, mainly aims at connecting its public and private sector members as well as increasing their (international) visibility. While the cluster has recently shifted towards mobility, circular economy and sustainable cities and smart technologies (EcoInnovation Cluster 2017), research into sustainable building has been identified as a transversal axis for the implementation of the cluster's priorities since 2012 (Ministère de l'Economie et du Commerce extérieur 2012) under the label of eco-construction and materials. In line with this, Luxembourg's promotional website[3] advertises Luxembourg's research and innovation competences in environmental technologies, particularly emphasising the

[2] The Greater Region is a geographic region including the Saarland and Rhineland-Palatinate in Germany, the French Lorraine region (now part of the Grand-Est region), Luxembourg and Wallonia (together with the French Community and German-speaking communities of Belgium).

[3] http://www.luxembourg.public.lu/fr/investir/secteurs-cles/technologies-environnementales/index.html.

country's relevant research facilities. To provide a further platform for reflection and exchange, the state together with the industry's main representatives launched in 2015 the CNCD. The new structure is conceived as a think tank addressing challenges and development in the building sector. Current members are the main representative associations of the construction sector (including construction firms, architects, planners, developers, building material suppliers and specialised engineers) and government officials from the four concerned ministries (housing, environment, economy and energy and public works). The press announcement following its creation explicitly mentions the objective to increase Luxembourg's international visibility and competitiveness in the field as part of an initiative of *nation branding* (Ministère de l'Economie 2014b).

Initiatives that seek to increase the profile or brand a city or region internationally to attract visitors, workers and investment are well studied in the urban literature under the concepts of city marketing and urban entrepreneurialism (While et al. 2004; Jonas et al. 2011; Andersson 2016). But similarly to Cidell's (2015) observation with regard to the performativity of green leadership in US local authorities, this branding of Luxembourg follows not only an extrovert but also an introvert, citizen-oriented logic (Affolderbach and Schulz 2017). In this second aspect, objectives are to support employment and development in the second most important economic sector of the country but also to increase or at least secure quality of life for residents in the context of growth pressures and most notably the frenetic construction activity and increasing strains on infrastructure.

This coalescence of local economic preoccupations with sustainability elements provides for a locally contingent sustainability policy fix (While et al. 2004) in green building, which despite its sectoral and technological component is still strongly characterised by state-led interventions. The Ministry of Economy in close collaboration with the sector's lobby associations and professional chambers has deployed strong efforts to increase competencies as well as to streamline the multiplicity of players in the field around coherent objectives and actions. This "clean up commando" (Public sector employee, Lux05) is strongly articulated around a technological fix approach and mainly materialises along three lines of action: (1) realisation of lighthouse projects, (2) implementation of building metrics and certificates and (3) capacity building and structured exchange with and within the industry through platforms like the EcoInnovation Cluster and the CNCD. This last aspect is reminiscent of the strategy deployed with regard to energy-efficient building.

Leading developers have adopted this agenda and further infused it with their own visions and projects. The current president of the EcoInnovation Cluster, for instance, has markedly contributed to positioning the cluster on the topic of circular economy, based on his work experience and engagement with the real-estate market. Another example can be found with the director of the Council for the Economic Development of Construction (CDEC), who strongly supports the sustainable building agenda but has complemented it with a smart building/smart city approach. Since 2013, an annual conference with international speakers from service providers and model smart cities but also Luxemburgish actors promotes this vision. It is organised by Neobuild, a subsection of the CDEC that is cofinanced by public innovation funding from the Ministry of Economy. Neobuild further functions as an innovation hub for sustainable construction (Fig. 8.4).

Fig. 8.4 The Neobuild Innovation Centre (Photo courtesy of Neobuild)

These different visions and priority settings are not only specific to the private sector; government initiatives similarly promote different *Leitbilder* which appears at odds with the streamlined objective outlined above. For example, the cluster was renamed from EcoDev (2009) to EcoInnovation (2013), while Luxembourg's promotional website advertises a thriving clean technology sector. Strategic studies have led from an Action Plan on Eco-technologies (Polfer 2009) and a study on the circular economy in 2014 (Hansen et al. 2014) to most recently a strategic study for a Third Industrial Revolution (The TIR Consulting Group LLC 2016) emphasising digital components. The latter provides a general blueprint to transform the country's economy to reach a *smart society* by 2050 and has been produced jointly by local representatives and team members of Jeremy Rifkin's Third Industrial Revolution consultancy. It includes a detailed scenario for buildings, which, given the involvement of local actors in its conception, makes an effort to consolidate several of the different promoted visions. The initial statement around the imperative for (energy) retrofit is further presented as the key opportunity to upgrade towards intelligent and smart buildings that achieve energy efficiency due to self-regulating and networked digital technologies that respond to feedback mechanisms within the system. A total circularity of the material used in buildings and quality of life reached through human-centred urban design are the other dimension of the study's future vision on buildings (The TIR Consulting Group LLC 2016). While the diversity in approaches might in part be owed to efforts to conform to the fashion of the day, there is still a coherence in the overall narrative or fix: the (sustainable) construction sector as a key contributor to the national economy with international export potential is seen as a way to demonstrate innovativeness and ensure quality of life through a decisively ecological modernisation approach.

A further illustration on how that fix is concretely articulated can be found in a certain fondness of building certificates. The certificates are perceived by building owners as an objective set of metrics designed to judge, compare but also better showcase a building's sustainable quality through a list of clear indicators. The energy performance certificate (Sect. 8.2) already provides one such framework, but owners and/or occupants of large office buildings in the "office islands" of the financial service industry (Hesse 2016: 618) have proven especially keen on having their building certified according to international green building schemes. Fourteen per cent of the office building stock is certified according to a range of different standards including BREEAM, DGNB, HQE and LEED (see Table 6.1 as well as PwC Luxembourg 2015). Stated motives are here linked to economic advantages in terms of improved commercialisation or occupancy rates following lower operating costs as well as to prestige. This trend has been mainly initiated by international investment funds that sought certified buildings for their investment portfolio creating a de facto demand and a market for sustainable certified office buildings. Certified office buildings are now almost seen as the norm, even though one respondent noted that the initial enthusiasm seemed to have died down. Green rationales are rather ancillary or even an obstacle as clearly stated by one consultant:

> The main argument for me is that once you have explained to people that [green building] makes economically sense, you convinced them. I have […] tried to communicate around […] environmental protection in the construction sector. It doesn't work at all. It convinces maybe…some percentage, I don't know if I could even say 10%, but it's a message that is extremely counter-productive. Of course, we are interested in protecting nature, there is no doubt! […] But in the end, protecting nature is good but it is mainly protecting it to keep a nice life environment for us and the ones who will follow. And thus, as a selling argument if you wish, it is a bad entry point in a milieu like construction. […] You will always believe in something once you've seen the positive economic returns. These returns can vary a lot. I don't say it doesn't make sense to do it, I simply say that the way you present it… having less… if you talk about corporate social responsibility, if you talk about sustainable building, construction of healthy buildings, less unsatisfied tenants etc. These are all purely financial arguments. (Lux12)

Building on the competitive advantage of Luxembourg's multilingual and multicultural environment, the construction industry has even advocated a diversity of certification schemes to communicate openness and flexibility towards international investors:

> We are a small country and we need foreign investors here, we need to differentiate ourselves from the neighbouring countries. In France, they almost only know HQE, even if there are other schemes, in Germany it's DGNB and in English speaking countries BREEAM, or LEED if it's an American pension fund that wishes to invest. I believe we have an interest to stay open to all these certifications, so we can offer a know-how stating: "You're coming here to Luxembourg and you want to invest in an office building, you can have it certified in BREEAM, DGNB… we have the know-how, French, German, English… We are at the crossroad of German-speaking and French-speaking countries, so we can fulfil your expectations. (Private sector representative, Lux01)

The private sector has positioned itself differently from the government who seek to streamline and adapt certification systems to the Luxemburgish context as a way forward to improve knowledge and skills. The use of one unified system is seen

as a way to reduce complexity while offering planning security for the national construction industry. Despite a shared feeling that the practice of international certification tools has brought the sustainable building agenda forward by increasing awareness but also technical proficiency on the topic, some respondents regretted that it sometimes amounted to a retroactive box-ticking exercise without leading to more thoughtful and comprehensive sustainable planning from a building's conception onwards. This position is comparable to positions from experts and respondents in Vancouver (Sect. 6.6).

Similarly, the provision of lighthouse green building projects is seen as crucial to demonstrate leadership and innovativeness at the international scale but also to create emulation and capacity building at the national level. Interviewees frequently pointed towards the low number of such projects as a hindrance in two ways. First their absence is perceived as harmful to the visibility of Luxembourg's existing green building expertise even though expertise was seen as already comparable to other emblematic and model cities like Freiburg or Masdar, but just not advertised well enough. Second, the lack of lighthouse projects is seen as a deterrent for experimental spaces through which different building methods and technologies could be tested and hence contribute to local know-how. Potential lighthouse sustainable building projects are thus perceived as indispensable displays for the sector to coalesce around and identify with. However, a number of recently finalised building or planned projects have been identified by respondents as having the potential for becoming such lighthouse projects (see Sects. 8.3.1 and 8.3.2).

8.3.1 The Solarwind Office Building in Windhof

The Solarwind building in Windhof is one project with lighthouse character, initiated and developed jointly by three Luxembourg-based companies (two real-estate developers and one engineering consultancy) (Fig. 8.5). In use since 2012, the office building hosts amongst others two of its initiators. It is located 15 km away from Luxembourg City, close to the Belgian border (Fig. 8.1). CO_2 neutrality is reached through a combination of high insulation standards, notably via a wood facade, the partial provision of on-site energy production with different forms of renewable energy (solar, wind, geothermal and biomass) and a green sourcing contract covering the remaining electricity demand. Rainwater is also captured and the external design features a green roof and facade. The interior furniture partly applies circular economy principles, for instance, by using upcycled fittings and office furniture as well as recycled carpets. As acknowledged by one of the project owners, some of these features are key to a building's visibility and much more about communication than contributing to its sustainable character:

> For a project to work […], you need *gimmicks*, you need things that are visible, that are visual, that people look at. Because [in order to] do a high performing building, you need extraordinary things even if they are small things that people remember, that they see, so that it sells. Think about BedZed and its famous chimney! (Solarwind owner, Lux12)

Fig. 8.5 The Solarwind building: green façade, solar panels and roof wind turbines (Photo: Bérénice Preller)

Several further aspects have helped to position and present the building internationally. Solarwind has notably been awarded three certifications from three different green building schemes: the French HQE, the British BREEAM and the German DGNB schemes. The initiators justified the triple certification strategy as a pedagogical test to verify compatibility between the certification schemes. But they also use it to showcase their green building competencies, as they are themselves active in the real-estate market. Constant monitoring and visualisation of energy and resource consumption allow fine-tuning and adaptations to the building use but also dissemination of project performance as the information is shared with researchers at a university in Belgium. In addition, Solarwind acted as a national pilot site for a European-funded research consortium, which collaboratively seeks to enhance the implementation of cradle-to-cradle principles in new and existing business estates. Eventually the building's model character has been internationally acknowledged in 2015, through its nomination for the green building solution award competition of Construction 21, a social media platform targeting professionals from the sustainable building sector (Bosquet 2015). Furthermore, the project has contributed to group the surrounding firms within an economic interest group, the Ecoparc Windhof, which aims at facilitating inter-firm pooling in terms of rational resource use, material efficiency and management (material loops) and personnel mobility within the business park.

8.3.2 The Neobuild Innovation Centre, Bettembourg

As has already transpired from the role attributed to certification and lighthouse buildings, increasing capacities and expertise at the local level is considered a crucial element of the sector's international competitiveness and its ability to put sustainable building into practice. Accordingly, lifelong learning plays a pivotal role in Luxembourg's green building agenda as apparent in the initial excerpt from the governmental coalition programme. In addition to targeted training with regard to energetic building (Sect. 8.2), sustainable construction is also a central axis in the lifelong training offer of the Engineers and Architects Professional Association. The course is provided together with a Luxembourg-based applied research centre specialised on environmental technologies and materials. Likewise, the LuxBuild initiative (see Sect. 8.2) seeks to advance blue-collar workers' skills in the face of environmentally induced technical and organisational evolutions, but the initiative also aims at encouraging firms to innovate. A recently completed building, the Neobuild Innovation Centre (Fig. 8.4) in Bettembourg close to the French border (Fig. 8.1), has a particular role to play in that respect. The 2200 m^2 office building compliant with passive house standard was completed at the end of 2014. Conceived as a modular living lab, the building has been planned as an experimental and learning tool but also an international display of the sector. It is also headquarter to Neobuild, an innovation hub for sustainable construction cofinanced through innovation funding from the Ministry of Economy.

New and in some cases even experimental construction materials and technologies are showcased and tested in the Neobuild building through a combined use and mix of products. As on the UBC Campus in Vancouver (Sect. 6.4), the living lab approach provides space for experiments, learning and demonstration for new materials and building designs, but in the case of the Neobuild Innovation Centre, the focus is more market-oriented. A large number of service providers involved in the building's construction were local SMEs which were involved due to their innovativeness but also on sustainability criteria including social aspects, for instance, working conditions. Neobuild's objective is to allow these local firms to demonstrate their skills in green building, again under an extroverted advertising logic for the green construction sector in Luxembourg. Different types of insulation have, for instance, been used in adjacent wall segments; diverse heating and cooling systems have been implemented for different sections of the building, as well as several usages of collected rainwater including water supply to a roof greenhouse and a green wall, to name but a few. Technological solutions are also at the heart of the building, for example, through constant monitoring of the components through a range of sensors. The installation aims at allowing in vivo tests as well as a comparison of technological and other components' performance and user-friendliness, which participating firms are encouraged to profit from before implementing them in future building projects. The trial and error logic is pushed even further in an experimental area, where the used materials can be flexibly adapted and transformed to allow for technical evolution. Similarly to the Solarwind building (Fig. 8.5), the

Neobuild Innovation Centre has been a laureate of the green building solution award competition of Construction 21 in the category smart building.

Based on the previous account, awareness of sustainability dimensions and sustainable change (Andersson 2016: 1200) in buildings has been triggered by compliance to external pressures like European or international agreements and then selectively framed through a political vision with dominant economic motives. Strengthening the local building industry by making it fitter for implementing innovative technical building solutions (eco-technologies) is expected to promote visibility at an international level that will eventually attract external capital but also offer export opportunities (see also Table 8.1 for a summary). This approach presents a sustainability fix or coherent "coalition around new urban growth strategy" that While et al. (2004: 565) observed in Manchester and Leeds. But as these authors further discuss in their conclusion, governmental steering towards greening can still create a momentum for more transformative alternatives. An analysis of actors involved in the practice and realisation of sustainable buildings in Luxembourg has, for instance, revealed unconventional assemblages, including environmental NGOs (Schulz and Preller 2016). In addition, alternatives, understood here as more paradigm-shifting and socially sensitive approaches, are gaining ground in Luxembourg due to their link to a central everyday concern for citizens: the scarcity and unaffordability of housing.

Table 8.1 Green growth and eco-technologies. Contextual sense-making of green building in Luxembourg (Categorisation after Dryzek 2013)

Green growth and eco-technologies			
Entities	Assumptions about nature relationships	Agents and motives	Rhetorical devices
Finite fossil resources, climate change and security crisis	Ecology and economy compatible	State (economy), sectoral representatives (business and employees associations), key individuals (private developers)	Quantitative analysis and standards (CO_2 objectives, energy efficiency, employment, etc.)
Private sector = growth motor, state (Ministry of Economy) = enabler	"Promethean" approach: technical fix and manageability	International obligations and commitments (Kyoto, EU 2020, etc.)	Rationalisation and efficiency via administrative pragmatism
Economic diversification through eco-technologies and construction as high-impact sector		Pursue (sustainable) growth through synergies between energy policy and economic development	Training and capacity building, positive for the whole sector
		Reduce energy dependency and costs (negative for economy)	Buzz words: green growth, eco-innovation, cleantech, circular economy, smart cities, etc.
		Position Luxembourg on the map: "branding" as innovative and dynamic	

8.4 Sustainable Housing: Addressing Issues of Quality and Affordability

Housing in Luxembourg is worth an in-depth look as it offers potential for a different perspective on sustainable building. Quality of life is once more a central element in the narrative but supported by different motives and arguments. The housing market is indeed considered to display expectations for highly qualitative building fabric and finishes (Stadtland 2009: 8–9), as it is driven by high disposable income levels. At the same time though, scarce supplies on the real-estate market undermine this quality demand following the customers' willingness to pay for housing—even housing at relatively low standards—which has led to an overheating of the real-estate market.

Nevertheless, respondents felt that the energy efficiency agenda and the performance certificate have been well received amongst homeowners and tenants. They were generally perceived as a way to reduce expenses, increase in-house comfort and also a metric that shows "that they have the best house" (Public employee, Lux13). As a result, consumers are presented to be better informed and more sensitive to healthy living themes like ecological building materials and indoor pollution as well as comfort and accessibility (PwC Luxembourg 2015) which contributes to a widened understanding of sustainable building beyond the purely energy- and resource-saving aspects.

Here again, certification schemes and notably the associated databases for building materials are highly regarded, as they are perceived to provide sound information on the materials' environmental performance, thus allowing an informed decision. The certification approach is however simpler and more straightforward than the international frameworks favoured in the commercial building sector. PWC Luxembourg (2015) further argues on the basis of an inquiry amongst developers, architects and real-estate agents that given the current quality standards, most of the certification requirements could be achieved anyway with a minimum of efforts.

Unlike the energy-efficient and green economy approaches to building outlined above, the non-governmental sector is more present and involved in sustainable housing questions. Especially the non-profit Oekozenter Luxembourg, belonging to the local Friends of the Earth structure, is particularly active in disseminating best practice on environmentally sound and healthy building materials. The Oekozenter has set up a whole range of initiatives targeting individuals: building advisory services and the organisation of the Oekofoire,[4] an annual trade fair exhibiting ecological products including housing solutions, or the *Gréng Hausnummer* (green house number), an annual voluntary and checklist-based assessment to award sustainable housing. The Gréng Hausnummer mainly aims at demonstration and dissemination. In addition, the Oekozenter has also contributed to formalising these topics at a policy level due to its policy advisor activities for its main funder, the Ministry of Housing. This includes preliminary work for a sustainable building guide comprising extensive descriptions and evaluations of building materials, for instance, in respect

[4] Following the 2016 edition and almost 30 years of existence, the Oekofoire will be discontinued.

to their embodied energy, their toxicity or their lifetime (CRTE et CRIT-B 2010). The final version of the guide has been continued by the Research Centre for Environmental Technologies (Centre de Recherche pour les Technologies de l'Environement),[5] a local applied research centre focusing on environmental technologies and materials, and is now a well-established resource for the sector. Similarly, the Gréng Hausnummer provides the preliminary basis for the set-up of a voluntary sustainable housing certification system: the LENOZ scheme. In preparation since 2009, the detailed composition of this sustainability certificate adapted to the Luxembourg context has been outsourced to an engineering consultancy and is part of a legislative proposal currently under review to promote sustainable housing. The criteria catalogue of the certification is particularly interesting: it covers of course economic aspects, measured through energy savings, ecological elements like building materials and resource consumption but also further evaluates social aspects, including urban sustainability considerations related to a building's surroundings and accessibility (Gouvernement du Grand-Duché de Luxembourg 2016). Together with the LENOZ[6] certification, the government has further introduced a climate bank system, providing attractive loans to households for energy retrofitting according to socio-economic criteria.

While these aspects certainly broaden the previously described focus on resource efficiency and individual buildings towards broader contexts, the framing of sustainability in housing as a warrant of quality again provides for relatively conventional building solutions (see Fig. 8.3). Furthermore, and as already mentioned above, quality of life is promoted through eco-technologies and a green growth agenda at the policy level. As such, sustainable housing can be considered to be consensually framed as "a middle-class policy of the living place rather than a politics of sustainable urban development" (While et al. 2004: 565).

Yet, the elements discussed so far are not providing the whole picture on sustainable building and liveability in Luxembourg. While questions about the local understanding of sustainable building usually received answers along the previously outlined aspects (including energy efficiency, capacity building and eco-technologies), almost all interviewees pointed to the challenges arising from the very peculiar real-estate situation. As already outlined, the Luxemburgish real-estate market has indeed been characterised by scarcity. The aforementioned development (Sect. 8.1) of the country as an international financial centre has led to an increased demand for office buildings but also for housing, as a high-skilled workforce attracted by the financial sector as well as EU institutions is drawn from abroad (Hesse 2016; Becker and Hesse 2010). Due to an additional increase in housing demand driven by a reduction in household size, Luxembourg is confronted with very pressing housing shortages. According to previsions, over 6000 new units would be required every year to meet the growing demand (Urbé 2012; Bousch and

[5] Since the merger of the two main research centres in Luxembourg in 2015, the Research Centre for Environmental Technologies has been integrated within the Luxembourg Institute of Science and Technology.

[6] LENOZ is a voluntary sustainability certificate for residential buildings in Luxembourg (Lëtzebuerger Nohaltegkeets-Zertifizéierung).

Licheron 2012). This has led to steady price increases in the rental market, which rose by 22% between 2002 and 2015 (Bingen 2016), and in the property market, which rose by almost 190% between 1995 and 2010 (Hoffmann 2012). The pressure is reinforced by a tendency to prioritise office development (Hesse 2016; Hesse and Christmann 2016). The fact that property is mainly in private hands has favoured speculation (Urbé 2012) but also skewed the market towards offering more property than rental units and houses (Becker and Hesse 2010). In addition, affordability challenges have been only weakly addressed by public housing providers: social housing only made up for 3.6% of the stock in 2009 (Stadtland 2009: 16). As a result low-income and middle-class households are pushed out of the market, forcing some of them to seek accommodation within the neighbouring countries (Becker and Hesse 2012). This in turn increases the already high flow of daily work commuters (171,000 in 2016) and puts further strains on the transport infrastructure. There was hence a diffuse feeling that any economic or moral arguments for sustainable housing choices become negligible or even redundant due to the heated real-estate market. In practice, this seriously limits more comprehensive approaches to sustainable building including urban design and spatial planning aspects:

> There is a challenging deterrent here in Luxembourg that always sets the best argument in the shadow: it's the situation of the real estate market. It's no secret. The prices are what they are, the distress of people to get an apartment is what it is […] And it makes it certainly difficult if sustainable building… or when trying to explain that it's more sustainable not to live in the North [of the country] and then to commute by car x kms into the city. You can argue about this, it's true everybody can grasp it. But when someone looking for accommodation gets into the real estate market and realises, that in the North it is simply so much cheaper, then you can explain a thousand times, they may even agree, but they can't afford it otherwise. And I see this as a huge problem, a huge barrier. (Public employee, Lux13)

These everyday concerns of at least parts of the population bring a strong social dimension into the discussion, opening the way for alternative approaches to green building. Sustainable urban planning has been the main tool to address these issues, thus moving away from the focus on individual dwellings or buildings as addressed in the green growth and technology-driven agenda towards the neighbourhood and urban scale. Similarly to Moore and Rydin's (2008) observation, the sustainable urban planning agenda puts more emphasis on the role of public actors: in Luxembourg, the Ministry for Sustainable Development and Infrastructures as well as the Ministry of Housing are the respective institutions which played only a marginal role in the development of the eco-technological and growth agenda described above. Key policy instruments include (1) the Housing Pact (Pacte logement) set up in 2008 which encompasses conventions between the state and municipalities, as well as financial and legislative tools (Gouvernement du Grand-Duché de Luxembourg undated) and the more general planning approach of the (2) Sectoral Housing Plan (Plan Sectoriel Logement), introduced as draft document in 2009. The finalised version of the Sectoral Housing Plan had to be withdrawn shortly after its publication in 2014 following criticism based on legal aspects and insufficient consultation of local authorities. Both documents have to be understood in the wake of a more systematised approach to spatial planning in Luxembourg that seeks to transition towards integrated development of the differ-

ent socio-economic functions and geographic regions of the country (Hesse 2016; Chilla and Schulz 2011) with sustainability as the assumed normative goal (Carr 2011). The main objectives are polycentric growth concentrated on several urban centres, as well as infill development, increased density and mixed developments at the urban scale. For housing this concretely translates into concepts of public transport accessibility, reduction of land consumption and increased density, mix of functions, creation of qualitative public space but also efforts to increase availability of public housing. The focus lies here on the neighbourhood or even larger urban scale, with key projects and growth areas identified throughout the whole country (Stadtland 2009). While more social in scope than the green economy perspective, these plans have been still categorised as too theoretical and planner-led to be truly integrated into a public understanding of sustainable building:

> Every type of actor has its vision on the topic. Talking about sustainable construction, it's really putting a big name on things that are sometimes really different […] you are not exactly addressing the questions that arose to most people who renovate a house, buy a house or renovate an apartment, change window frames. You have to see at which level you situate yourself. That's what I think…when I was talking about professions, building firms, they are really into this: changing window frames, insulate a house, change the boiler, make energy saving, how much does it cost? Is it more expensive? How much? Do I get funding? All this is one approach to sustainable building, it's a very concrete and very technical way to handle all this. (Architect, Lux15)

At the same time, densification is met with scepticism amongst citizens and local media as it is perceived as a threat to the current architectural aesthetic and quality of urban living, even though the housing prices significantly contribute to a pragmatic acceptance. Hesse (2016) has further pointed to the constraints of political economy practices favouring private and real-estate economic interests due to different rationales between the local and the national level. While being national level policy approaches, these instruments have the merit to articulate a key question for socially inclusive understandings of sustainable construction: Which "forms of living together" (Consultant, Lux05) or which "spirit of social cohesion" (Developer, Lux11) does the country envision for its future?

In this context, several mainly non-governmental initiatives are calling for alternative approaches to address the housing crisis. In 2012, Caritas Luxembourg focused its annual publication on the social situation in Luxembourg around the topic of sustainable housing and living. The report provides a very thorough analysis of the aforementioned socio-economic challenges but also sketches concrete solutions like cooperative housing throughout a wide range of articles by academics, non-profit and institutional actors (Schronen and Urbé 2012). Since 2014, the citizen initiative Adhoc is also placing cooperative housing onto the agenda via conferences, participative workshops but also the realisation of a housing project in Luxembourg City. Increased public and political recognition of alternative approaches is visible in Luxembourg's 2016 contribution to the International Architecture Exhibition La Biennale in Venice. The exhibition indeed also brought alternative housing solutions to the forefront and inscribed them within the concept of Tracing Transitions, seeking traces of and calling for a structural shift away from the current housing situation and policy configurations (LUCA 2016; Christmann et al. 2017).

8.4.1 Hollerich Village

Hollerich Village is another example for raised awareness and interest for alternative projects. The privately planned neighbourhood development on four hectares of a former industrial site at the edge of Luxembourg City's centre (see Fig. 8.1) was frequently quoted as a particularly ambitious model project with regard to sustainable building and living. The area belongs to a private developer already involved in other sustainable building projects including the Solarwind office building. The planned new urban quarter is foreseen to offer residential and office space in line with the "One Planet Community" principles developed by Bioregional. The UK-based foundation provides advice for reference projects worldwide and has notably been involved in the internationally renowned BedZED project. For Hollerich Village, this would translate into reduced energy consumption with 100% of heat and 20% of electricity generated on-site (100% renewable energy), a pedestrian-friendly urban design, good integration with public transportation, the re-naturalisation of a creek crossing the site and a cradle-to-cradle concept aiming at getting all building materials from within 150 km of reach. A community garden is also planned, not the least since local food production is given key importance. Despite its flagship potential, discussions with the city administration regarding acceptance of the master plan for the development stalled, and the developer has reassessed its investment priorities putting the project on hold for the time being. The fact that the project site belongs to a larger brownfield area with different owners including the city, the state and a major tobacco company explains—at least partially—the lengthy negotiations. It has indeed proven difficult to devise a common vision for the development of the area amongst all landowners, which seems to be an important criterion for the city as the site is strategically located at a main entry point into the city centre.

Despite being currently on hold, the project initiated several interesting partnerships with local environmental NGOs during its planning phase. These include a transition town group, the Centre for Ecological Learning as well as local primary schools invited to use the project as a sustainability teaching case. These partnerships have also led to a number of events, including an annual trade fair for organic plants on the intended development site. The recruitment of a consultancy entrusted with the communication of the project between 2013 and 2016 has resulted in public awareness of the project and also positive framing of its sustainable image, thus reinforcing its model character (Schulz and Preller 2016). As a result, and despite its unknown future, the project has connected actors with alternative perspectives on sustainable building and provided them with a public platform that increased their visibility.

While the housing and affordability agenda is putting sustainable building into a much more holistic and interactive relationship with its surroundings, some elements are still reminiscent of the previous growth and eco-technology agenda. Quantitative data, specifically on land and housing availability as well as population figures, are again very central to the argument. Similarly, a key motivation is again to maintain quality of life even though this is here understood as a socially inclusive

project rather than the mere perpetuation of an affluent way of life. Finally, key actors are again public authorities and other institutions that wisely act for the common good even though the Housing and Sustainability Ministries may be expected to follow different objectives than the Ministry of Economy. By default, the key role taken by these actors shows that citizens are notably absent from the debate, with some rare exceptions (e.g. the Adhoc initiative). If at all, they are mainly apprehended as consumers within the green growth and eco-technologies approach and as subjects at the mercy of the housing market within the affordable housing and urban planning approach.

8.5 Conclusion: Green Building for Quality of Life?

The chapter demonstrates ambiguities in understanding of and differences in approaches to green building in Luxembourg. As Moore and Rydin (2008) argue, the topic is perceived as diverse and understood in different ways by actors as emerged from the research presented here. Guy and Moore (2007: 16) highlight the plurality of knowledges and escorting "truth claims" at stake in sustainable buildings, thus recalling contested issues in sustainable development in general. Nonetheless, as has been shown in the previous sections, sustainable building in Luxembourg is broadly framed along the lines of two recognisable agendas. These two agendas present a local meaning-making of sustainable building that materialises into three concrete building types: (1) highly energy-efficient but normal looking houses, (2) visibly different flagship office buildings with the corresponding technological show-off as a statement of innovativeness and (3) neighbourhoods with a range of urbanistic sustainability characteristics.

Dryzek's (2013) analytical tools and tabular representation of the content of environmental discourses provide an enlightening framework to summarise the arguments at stake in both agendas. As explained in Sect. 4.3.4, Dryzek typifies and classifies divergent environmental discourses as "shared ways of apprehending the world" when communicating on environmental topics (Dryzek 2013: 9) in order to measure how far these discourses break with the current dominant political-economic context of industrialism. While Dryzek's typifies nine ideal types of environmental discourses, his analytical tools can be easily applied to topically more targeted sustainability issues such as green building, as has been already shown by Bina (2013) with regard to the green economy.

In Tables 8.1 and 8.2, the left two columns on *entities* and *assumptions about nature relationships* retrace the ontologies at the basis of the analysed discourse or, in other words, the worldview and the understanding of human-nature relationships that determine the raison d'être of sustainable building. The right two columns on *agents and motives* and *rhetorical devices* provide more details on who holds a particular perspective on green building, for what reason and with which arguments. All together, these elements provide for a consistent storyline that is the common thread of the respective discourse.

Table 8.2 Affordable housing and urban sustainability. Contextual sense-making of green building in Luxembourg (Categorisation after Dryzek 2013)

Affordable housing and urban sustainability			
Entities	Assumptions about nature relationships	Agents and motives	Rhetorical devices
Limited land resources and demographic pressures	"Tragedy of the commons":	State (housing and sustainability) and institutionalised non-profit (Caritas, Oekozenter, etc.)	Quantitative analysis (population growth, consumed hectares, commuter numbers, etc.)
→ Accessibility to housing, density, mobility issues	Holistic vision including society and quality of life	Absent citizens	Impediments on life quality : mobility, accessibility, quality of life
Integrative and long-term planning (public plans and large urban projects)		Key role of expert and wise public manager	Barriers: time, cultural changes and motivation
Pressures, limits and (land use) competition		Persistence of a high-quality way of living (notably via health and accessibility aspects)	

Dryzek's categorisation has been further refined by Bina (2013) who, in her review of green economy proposals at the international scale, distinguishes between three approaches: (1) business as usual, (2) greening and (3) all change based on their transformative potential in respect to the current dominant socio-economic paradigm. The more transformative approaches question the core objectives of the dominant socio-economic paradigm than simply its means.

The energy efficiency and eco-technology approaches (Table 8.1) can be regarded as one perspective on green building in Luxembourg that historically started with the first to evolve over time into the second, more elaborated one. Due to the limited availability of natural resources (including fossil fuels and building materials), green building is seen as a way forward by rationalising resource consumption and securing the current way of living. Technological elements on the building fabric-like insulation or heating and cooling systems are largely seen as standardised and proved solutions to reach this rationalisation and hence central to the understanding of green building. As a result, the firms installing these technologies play a key role but with the state and business associations setting the tone through their role of facilitators. This encompasses on the one hand building standards for energy consumption and on the other hand adequate, mainly technical training of building professionals. Economy (in the sense of efficiency and resource saving) and ecology are here understood as compatible. By extension, if Luxembourg is able to position itself at the forefront of ecological building technologies, this will even more conveniently serve its economy and its model of affluence through sectoral diversification and reputation building. In addition to institutionalised actors, this

agenda has been eagerly endorsed by a number of proactive private developers, who have brought forward lighthouse projects and promoted Leitbilder including the circular economy to position themselves and their businesses as key interlocutors for the government.

Quantitative measurements of resource efficiency, economic impacts and standards amongst others are overly present in the narrative, while the focus lies mainly on single building realisations, combined with concepts currently in fashion like green growth, circular economy or smart cities. Together, green building appears here as a technical but also manageable topic, which primarily ensures continued economic growth. As such, green growth and eco-technology approaches in Luxembourg fall into Bina's (2013) business as usual categorisation rather than constituting a deep systemic transition.

The second perspective on green building in Luxembourg (Table 8.2) promises deeper and more substantial changes, which, if implemented well, may challenge the current development model more generally, shifting priorities from economic gains to social and environmental objectives. The affordable housing and urban sustainability perspective is more concerned with societal aspects of green building but in its structure still shows some overlaps with the eco-technology perspective on key aspects. The first and most obvious overlap exists in the primary justification of sustainable building as a response to limited natural resources, though here it is land and housing that are at stake rather than energy. As a result, quantitative measures are again rhetorically very present, this time mainly through demographics: population growth, numbers of commuters, evolution of housing prices, etc. Similarly, the topic of quality of life is the central line of argumentation but apprehended through health and accessibility to housing rather than economic wealth.

While the first perspective on green growth is publicly well articulated, the key trigger of the second one, housing affordability, was also very present in the public debate and throughout interviews. Nevertheless, adequate measures stayed at a programmatic and diffuse planning policy level and have even been further restrained by implementation difficulties. As a result, concrete realisations and policy outputs are up to now significantly less visible and articulated than building projects emerging from the green growth agenda.

Key actors in this more holistic approach to green building are again public agents taking the role of wise managers of the public interest together with some NGOs. Citizens, even though primarily affected, are however marginally active with the exception of consultations around planning documents and some rare single initiatives. Altogether, this second perspective still needs to become more decisively enunciated and concretised to be truly transformational. As it is currently articulated around quality of life impediments that are presented as mainly behavioural and lifestyle dependent, and thus more diffuse to influence, the narrative takes the focus away from a reassessment and reevaluation of the role of past political decisions on infrastructure and settlements. This strongly resonates with Shove's (2010) contention that behavioural approaches might keep more imaginative and potentially more transformational policy solutions at distance.

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Part III
Trajectories of Greening

Chapter 9
Cities as Seedbeds for Sustainability Innovations

Abstract Based on framings influenced by transition studies approaches, this chapter assesses local trajectories in Freiburg, Vancouver, Brisbane and Luxembourg focusing on local and regional framework conditions. More specifically, it discusses the extent and the ways in which the four cities can be understood as seedbeds or niches that allow (or inhibit) green building innovations to be developed and adopted. Linking back to the discussed weaknesses of the transition studies literature on spatial dimensions of sustainability transitions, the discussion also emphasises the role of flows and connections beyond the cities. Based on examples from the four case study regions, the chapter proposes replacing hierarchical interpretations of the MLP with flat ontologies, that is to consider cities as places where niche, regime and landscape levels are blended. Moreover, cities not only host niches (e.g. as location of innovative projects or vanguard organisations) but can also hold niche characteristics themselves, for example, through the political and institutional context they provide. These become obvious in the individual transition trajectories identified that have shown to be highly context specific and contingent.

9.1 Landscape as Context

A transition studies approach based on the multi-level perspective (MLP) provides a tool to analyse socio-technical changes over longer periods of time. The research presented in this book is focused on green building transitions based on the assumption that geography matters: past and current context conditions lead to specific degrees and types of innovativeness in the four city regions. The respective trajectories—or pathways as these terms are used interchangeably here—can be understood as the individual biographies of innovations, including their geographical context, legacies from the past and current dynamics.

While there is common agreement amongst geographers that place matters (Massey 2005), work on transition studies is weak in or even lacks place sensitive

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analyses (Gibbs and O'Neill 2017). Rather, transition studies research involves studies on national contexts and single sectors that overlook regional and local variation as well as cross-sectoral articulations (see Sect. 2.4). This chapter scrutinises the respective city level contexts in terms of their political, socio-economic and cultural dimensions. Following the concept of landscape developed in the MLP literature, context can be understood as the overarching (exogenous) socio-technical framework that influences niche and regime developments in a given sector (see Fig. 2.1).

Although landscapes are supposed to be relatively stable over time, they can change dynamically due to single events or decision-making as exemplified by the responses to the 1970s oil crisis or the changes in Germany's energy policy in the immediate aftermath of the Fukushima accident. This responsiveness may lead to highly contingent trajectories that are not only the result of adaptation to external shocks or long-term trends (e.g. demographic change) but also the outcome of an ongoing interplay between the landscape and the regime and niche levels.

Hence, landscapes are subject to continued change and adaptation, responding to pressures coming from the niche and regime levels. While landscape, regime and niche are frequently presented as following a hierarchical structure, even Geels himself tends to deviate from this initial understanding of MLP as a nested hierarchy. Rather he comprehends levels as "different degrees of stability, which are not necessarily hierarchical" (Geels 2011: 37). Landscapes are not bound to overarching territorial scales (e.g. national or international regulation) as sometimes erroneously presupposed by geographers who equal the MLP heuristic with a mere spatial hierarchy (for this critique, see Coenen et al. 2012; Murphy 2015). Instead, they are to be understood as a multi-scalar set of framework conditions. For example, regulatory factors determining innovative green building projects can stem from different administrative levels and may include international norms (e.g. EU regulation), national building laws as well as regional and local bylaws. The regulatory landscape is thus a combination of different administrative levels, allocated at different spatial scales. As this multi-scalar character of landscape is quite obvious in the case of administrative responsibilities, it is much more difficult to grasp and conceptualise when it comes to sociocultural aspects such as beliefs, norms, values and informal conventions that also influence the green building sector, for example, through lifestyles and consumption habits.

According to Geels, the notion of landscape

> highlights not only the technical and material backdrop that sustains society, but also includes demographical trends, political ideologies, societal values, and macro-economic patterns. This varied set of factors can be combined within a single 'landscape' category, because they form an external context that actors at niche and regime levels cannot influence in the short run. (Geels 2011: 28)

Geels' (2011) definition serves as a starting point for developing a landscape heuristic that enables assessing the varying context conditions in the case study settings. Table 9.1 illustrates these landscape dimensions using examples of possible articulations in the building sector. This framework can be used to systematically identify and evaluate landscape changing factors that occurred across the four case studies. These context conditions can be summarised as follows.

Table 9.1 Landscape dimensions

Dimensions	Possible articulations in the building sector (examples)
Technical backdrop	Building technology, construction material, management and monitoring technologies, skills and know-how
Material backdrop	Climate conditions, resource availability
Demographic trends	Population dynamics (age, social and spatial mobility), changing household sizes
Political ideologies	Energy policies/climate change mitigation, tools and incentives, prioritised energy sources and technologies
Societal values	Lifestyles/fashions, consumer behaviour, forms of living (together), cultural norms and preferences
Macroeconomic patterns	Socio-economic dynamics, economic policies (e.g. "green growth" strategies), energy mix, availability of mortgages and financial incentives

Source: own illustration, left column based on Geels (2011)

9.1.1 Technical Backdrop

The technical dimension of the green building landscape has not been subject to disruptive changes (i.e. key inventions) over recent years and is characterised by incremental advances in construction technologies, insulation material and techniques as well as building and energy management. However, the early developments, experimentations and adoption of solar energy technology in Freiburg and Brisbane can be considered a fundamental factor in changing local pathways. This pioneering phase has been predetermining for the subsequent renewable energy transition in Freiburg. And even though the vanguard research activities and building experiments marking Brisbane from the 1950s to 1970s have lost traction afterwards, a legacy remains as expressed in interviews as well as the University of Queensland's research agenda. Over the last decade, the declining costs of PV panels due to globalised mass production have supported further diffusion of this technology. More recently, the newly developed passive house standard is more than a regulatory change as it is also technology driven.

Moreover, the technological context conditions in at least three of the case study regions are marked by the presence and the impetus of international research centres. Fraunhofer ISE in Freiburg ranges amongst the global leaders of solar energy research. The University of Queensland has played a pivotal role in green building research in Australasia, particularly in the 1960s and 1970s, but also more recently through its Global Change Institute. The University of British Columbia (UBC) in Vancouver has set internationally recognised standards in the conception and monitoring of innovative university buildings (living laboratories) focused on the translation of green technologies into practice. Local stakeholders frequently identified these research infrastructures when asked about the most relevant factors for successful regional trajectories. The long-term legacy and current role of these institutions, as well as their autonomy and independence from the building sector regime, suggest overall stable landscape elements for the four case study regions.

9.1.2 Material Backdrop

At least two material dimensions of green building landscapes can be considered influential for the respective contexts. Firstly, in both Canada and Australia, the relative abundance and low price of natural resources and the resulting predominance of extractive industries at least partly explain persistent policies and macroeconomic patterns that discourage sustainable transitions in the building and other sectors. This particularly applies to the strong lobby of coal mining industries and related energy policies in Queensland. In Canada, the reliance on relatively affordable and low-carbon hydropower and availability of water for household consumption and industrial use inhibits concerns around energy and water conservation and challenges attempts to change consumption habits and modes of production.

Secondly, climate change—besides its political momentum—obviously has a material (or physical) dimension that may impact green building trajectories. Given current climate change dynamics, changing temperature and weather conditions are expected to have an impact on urban planning (e.g. flood prevention, overheating prevention) and building design. Temperature rise could further augment the demand for cooling of buildings in subtropical Brisbane, whereas increasingly milder, but wetter, winters are to be expected in Europe and Southwest Canada, with potential repercussions on future heating technologies and building standards. However, no concrete evidence for respective adaptation and anticipation strategies was found across the case studies. Only for Luxembourg, the so-called Rifkin report (TIR Consulting Group LLC 2016) addresses adaptation as one area to act upon, notably due to the potentially hazardous consequences of climate change. The focus is put on the need for adaptable infrastructure and the training of the next generation of building professionals to be aware and integrate that dimension in their work.

The resource and climate conditions presented here are not to be understood as geo-deterministic where factors inevitably lead to particular outcomes or trajectories. Rather, they are but one material aspect that emerged from findings and obviously have a certain impact on the respective contexts and future innovations in green building.

9.1.3 Demographic Trends

All four city regions are marked by high population increases and resulting pressures on real-estate markets and urban planning. But the demographic dynamics differ in terms of their nature, with variegated impacts on the building sector. The most telling example may be Vancouver where the strong influx of Hong Kong Chinese and other immigrants from East Asia have not only led to rapid population growth since the late 1980s but also to changing preferences as to the size and design of residential buildings. Investors from Hong Kong have both contributed to the boom of high-rise condominium buildings along Vancouver's waterfront as well as to the replacement of residential bungalows by much larger, mansion style dwellings (Ley 2010).

In contrast, much of the population growth in Luxembourg is a result of in-migration of young to middle-aged professionals, many of whom are highly skilled and work for the financial sector or EU institutions. They provide a high demand for high-end, expensive housing offering comfortable profit margins for real-estate developers. Consequently, many private developers primarily focus on these high-income target groups and have specialised in condominium buildings. Simultaneously, such purchasers are often less concerned about energy performance, rather prioritising finding a place to live as quickly as possible following their arrival in Luxembourg.

9.1.4 Political Ideologies

Regarding the political or ideological component of landscapes and context conditions, the findings suggest nuanced differences between the local trajectories of Vancouver and Freiburg, on the one hand, and those of Brisbane and Luxembourg, on the other. As to the two former, the consistency with which the legacy of the 1970s (environmentalism illustrated by Greenpeace and David Suzuki in Vancouver; Wyhl protests and green movement in Freiburg) is referred to by almost all interviewees is striking. Although the narrative of early environmentalism may be at least partly constructed and easily overrated as an immediate cause of the more recent green building ambitions, it has possibly created a societal climate and context that facilitates and supports the development of progressive local policies. In both cases, strong civic engagement has led to heterodox policy arrangements and governance patterns involving various kinds of NGOs. In the case of Freiburg, public engagement can be traced even further back than the 1970s movements as the Bürgervereine (informal community councils at the level of urban districts) have traditionally played a pertinent role in the City's governance processes.

In Brisbane, the city council's ambitions to lead the race for urban sustainability amongst Australian cities started in the 1990s but came to an abrupt end due to the change in the political composition of city and state government and the resulting growth policy. Here, the civic sector seems to play a more peripheral role. The non-governmental sector was less prominent in the case of Luxembourg.

As to the respective national and supranational (e.g. EU) political contexts, some major landscape changes were identified for all case study regions. Canada's federal government changed from welfare state oriented and environmentally more sensitive policies to the explicit neoliberal, growth and resource intensive orientation of the more recent past (e.g. the Harper government from 2006 to 2015). Canadian federal politics are also reflected in the provincial government of British Columbia that is anchored within a strong resource extractive economy and does not always share Vancouver's deep green alternative political climate. With Justin Trudeau's election as Prime Minister in 2015, a return of the federal government towards more ambitious climate change mitigation goals has been indicated, although there may be contradictions here. In a similar federalist setting, Australia's national politics, as

well as Queensland's state government, are not always aligned with the orientation of Brisbane's city scale policies. While in the 1990s and early 2000s all three administrative levels still shared similar visions on sustainable development policies that triggered the emergence of a green building sector, further conflicts and impediments became apparent over the last two decades, for example, when the State of Queensland did not approve the sustainable housing code designed by the Brisbane City Council in 2000.

In Germany and Luxembourg, energy transition policies have more explicitly been deployed over the last decade. Germany's post-Fukushima *Energiewende* (energy transition) preceded European policies, which partly adapted and set new rules and incentives for all member states. In Baden-Württemberg at the regional level, the Green Party majority in the coalition government since 2011 created a supportive environment for Freiburg's green strategies. Luxembourg's energy policy can broadly be seen as a transposition of EU regulation (albeit adopted earlier than stipulated by the EU). Nevertheless, Luxembourg still demonstrates endogenous initiatives, for example, in the realm of climate finance. Based on its commitment to international climate change mitigation policies, and profiting from the expertise and infrastructure of its international financial centre, Luxembourg started to provide specific tools for financing sustainable projects (Dörry and Schulz 2018).

9.1.5 Societal Values

The strengths of green attitudes and value systems shared by large parts of Vancouver's and Freiburg's population and decision-makers, in particular, have already been mentioned under the political context dimension. Such values are likely responsible for paving the way for bottom-up initiatives such as Vauban. The residents' commitment to sustainability is possibly less well developed and more superficial in Brisbane and Luxembourg, whereby it seems to be paired with more materialist mindsets at least in the Grand Duchy of Luxembourg. For both cases, these mindsets, together with higher resistance to change, explain the lack of civic engagement in and support for green building policies.

Social value systems are likely to be the parameter that is most complex and slowest to change in a sustainability transition as they relate to individual lifestyles, collective practices (Shove and Walker 2007; Shove 2014) and consumer preferences. Value systems are related to the disposition of private individuals, collective agency, key decision-makers and the longevity and density of alternative institutions that differ between what Noel Longhurst (2013) describes as alternative milieus and ordinary places that lack these characteristics (see Chap. 10). Despite technological changes, a green building is only as energy efficient as the lifestyle of its inhabitants. Similarly, policy-makers in more conservative environments may be more reluctant to adopt unconventional approaches compared to colleagues in more pioneering settings where frames of reference and value systems have changed.

9.1.6 Macroeconomic Patterns

In addition to the strong role of the resource sectors in Canada and Brisbane, the economic structure and policies of both countries are characterised by orthodox objectives of continued neoliberal, economic growth which promote technological fixes not just as response to environmental externalities but also as part of an economic diversification strategy which is similarly present in Luxembourg. Environmental or eco-technologies are framed both as a way to reduce resource consumption and environmental impacts (e.g. greenhouse gas emissions) and a way to contribute to a restructuring of the domestic economy through potential new, export-oriented key industries.

Another macroeconomic context dimension is the respective energy mix, which may cause specific lock-ins (e.g. into heating technologies) and which may influence the price structure for energy used in buildings (e.g. comparatively cheap electricity produced from hydropower in Canada or from opencast mined coal in Australia). Obviously, the price levels determine potential cost reductions trough energy savings. In Luxembourg, the strong dependency on electricity imported from the neighbouring countries (i.e. essentially from Germany for private household consumption and from France's nuclear power industry for the energy intensive steel industry) features amongst arguments for a strategically motivated shift towards renewable energy produced in the country (prospectively leading to energy independence). Furthermore, the access to financing co-constitutes this landscape dimension. For example, the availability of specific mortgages for green buildings or grants for energy efficient retrofitting may differ from country to country and thus provide different context conditions.

The landscape factors described here (and presented in more detail in the preceding case study Chaps. 5–8) only provide a selective portrait of the respective context conditions but were identified as the most significant factors in affecting niche activities in either supporting or inhibiting innovative developments in the case studies.

9.2 Niche Articulations

Chapter 1 introduced a broader understanding of innovation as applied in this book, which goes beyond technical advances in building technologies and construction processes. Innovations here further include (a) policies, programs and strategies (including financial incentives); (b) norms, standards and respective certifications; as well as (c) forms of organisation and social coordination (e.g. participative governance). Accordingly, the case studies presented here represent the wide range of possible innovations in the search for place specific niches. In the following, the main types of niche developments found in the case studies are summarised and then evaluated regarding their compliance with usual niche characteristics derived from the transition studies literature. This comparison between our empirical findings and the usual understanding of the MLP concept necessitates reconsidering, firstly, the concept of niches and, secondly, its articulation with the regime level (Sect. 9.3).

9.2.1 *Single Buildings and Neighbourhoods*

Single buildings or neighbourhood planning projects of a pioneering character have been identified in all case study regions (Tab. 9.2). In both Vancouver and Freiburg, such initiatives have played a pivotal role as they paved the way for subsequent projects (in the same regions and abroad) and contributed to the cities' reputation as green building pioneers. However, the framework conditions for those projects vary significantly and cannot be generalised or easily replicated.

In Vancouver, UBC as autonomous landowner and builder has combined building endeavours with its research expertise on building materials and operations. It has become a test bed in itself, deliberately using progressive university buildings as living laboratories for further innovation, monitoring and improvement. The Olympic Village is often considered as a singular case due to the strong global influence (International Olympic Committee) but has also become emblematic for progressive approaches to waterfront and brownfield development that resonates beyond Canada. It has also helped to establish stricter building regulations in the City of Vancouver.

The Heliotrope in Freiburg (see Fig. 5.3) has more than a symbolic function. Conceived and built as residential home by a local visionary architect, it was also conceived as marking the start of the city's successful green building trajectory. It

Table 9.2 Innovative buildings and neighbourhoods

Case study region	Project	Niche characteristics
Vancouver	UBC—C.K. Choi building	1990s flagship green building for Canada and beyond
	UBC—Centre for Interactive Research on Sustainability (CIRS)	Living laboratory for sustainable science
	Olympic Village/Southeast False Creek	Impetus of the IOC/high international visibility
Freiburg	Heliotrope	Prototype conceived, built and inhabited by pioneering architect
	Solarsiedlung (solar settlement)	Plus-energy neighbourhood
	Vauban (excl. Solarsiedlung)	Comprehensive master plan; strong civic participation
	Buggi 50	First high-rise building complying with Passive House Standard; social housing
Luxemburg	Solarwind	Pioneering initiative of private developer; plus-energy and cradle-to-cradle interior
	Neobuild Innovation Centre	Showcase building/experimental lab for green building firms
Brisbane	Green Square and Common Ground	Multi-storey affordable housing projects
	Global Change Institute	Living laboratory for sustainable science

can be seen as one of a number of local developments that helped prepare the ground for further pioneering projects such as Vauban and the Solarsiedlung or the Buggi 50 refurbishment as a multi-storey passive house.

In Luxembourg, Solarwind with its plus-energy concept, triple certification (BREEAM, HQE, DGNB) and cradle-to-cradle approach became emblematic for what can be achieved by intrinsically motivated developers. Moreover, the building sector itself invested in a model building (Neobuild) with a showcase and experimental functions where local firms can demonstrate and further refine their skills. Brisbane's Green Square and Common Ground buildings reconciled affordable housing and green building imperatives in a large-scale operation.

9.2.2 Policies, Programmes, Strategies and Financial Incentives

Amongst the policies and programs scrutinised throughout the project, Vancouver stands out with its series of ambitious, comprehensive and clearly labelled strategies which all relied on strong civic support. Starting with the 1970s building vision today known as Vancouverism and the EcoDensity Charter from 2008 to the current Greenest City 2020 Action Plan (Affolderbach and Schulz 2017), the City of Vancouver has consequently pushed the green building agenda forward. The same applies to Freiburg although its policies were more incremental and less strategic (with the exception of the Freiburg Standard which was programmatically labelled). More recently, both cities reoriented their policies towards global leadership ambitions (see Chap. 10). Brisbane, however, is marked by strong discontinuities in its political agendas (flip-flop policies).

9.2.3 Norms, Standards and Certifications

The Freiburg Standard can be considered as a pioneering approach that served as a model for German building standards over more than two decades and has been partly adopted at the EU level. Besides being an early adopter of the LEED standard, British Columbia was amongst the first governments to introduce a revenue neutral carbon tax on fossil fuel consumption. The Green Star scheme established by the Australian Green Building Council arguably offered a strong impetus for developments in Brisbane's commercial building sector, although the state government did not approve Brisbane's progressive sustainable housing code in 2000. Finally, LENOZ as Luxembourg's new domestic certification scheme for sustainable residential buildings tries to take into account the challenges of a multicultural and multilingual setting where different planning and building approaches intersect.

9.2.4 *Forms of Organisation and Social Coordination*

Innovative approaches also occurred regarding forms of functional organisation and social coordination. The early building groups (Baugruppen) and building cooperatives in Vauban suggest a renewed trend of civic engagement and public participation, as does the neighbourhood's energy cooperative. Launched in 2011 as a collaborative project between the City of Vancouver and the public higher education institutions, CityStudio provides a platform where students, planners and members of the local communities develop and discuss innovative ideas (on CityStudio, see Affolderbach and Schulz 2017).

In Luxembourg, the conception of the Hollerich Village project—despite being initiated by a private developer—included a wide range of corporate and non-profit organisations, including environmental NGOs. NGO involvement also seemed to be key in Brisbane's residential projects, as the Common Ground initiative for affordable and supported housing shows, even though these initiatives are exceptions rather than the norm.

9.3 Reassessing the MLP: Contextualised Contingencies

The types of innovative projects, strategies and norms summarised in the preceding section only partly match the usual understanding of niches as protected spaces where technological advances and inventions can be developed outside the practical and market constraints of everyday routines in a firm or sector. Independent of the question whether the examples presented can be considered radical or incremental innovations in the transition studies' sense, at least some of them have shown a long-term legacy, in part inciting disruptive changes. Green building innovations tend to occur more frequently in particular urban contexts that tend to be associated with certain landscape characteristics. Even though the city scale should not be reified or overrated as natural seedbeds for innovations, the findings contend that cities—or city networks—themselves have inherent niche characteristics, as their supporting structures foster developments in the green building sector.

The latter is most obvious in the cases of Freiburg and Vancouver where consequent urban policies (the Freiburg Standard, Vancouverism as well as EcoDensity) have paved the road for progressive ways of planning and construction and have (sought to) become models for other cities following their example. In both cases, particular context conditions at the landscape level seem to have underpinned if not enabled the emergence of these innovations. As shown in Sect. 9.1, context conditions such as political ideologies or societal values have to be understood as complex systems of influencing factors. They are superposed in a multi-scalar setting that creates a place-specific environment, which is however not bounded to a contiguous territory. Yet, the actual outcome of such advantageous settings remains highly contingent. Context conditions change over time, and it became obvious that

many of the identified pioneering activities derived from temporary windows of opportunity (e.g. the emergence of the green movements in the 1970s, nurtured by open-minded local communities). While those windows of opportunity seem to be a necessary precondition for progressive initiatives, they are by no means a guarantee for continued success as, for example, the early years of solar building research in Brisbane show. Given the complexity of the influencing factors, the subsequent trajectories are serendipitous and by no means predictable. Not least, the legacy of niche developments strongly depends on the individual disposition of the respective regime, that is, the extent to which the established industry and its stakeholders are ready to adapt to new challenges. For example, the incumbent building sector in Vancouver possibly reacted differently to new environmental imperatives than the one in Brisbane. Again, the absorptive capacity of regimes, their openness towards change, is subject to manifold influences (e.g. from the landscape level) and complex agency patterns (e.g. the dynamics inside a comparatively stable but still continually evolving regime).

As the complexity of these articulations between niches, regimes and landscapes shows, the allegedly simple MLP heuristic partly builds on misleading categorisations and possibly too narrow definitions, in particular of the niche level. At the same time, the supposedly stable landscape category might need to be understood as more dynamic through its constant interaction with various regimes and horizontal landscape changes. Moreover, the empirical findings confirm Geel's (2011) proposition to resign from understanding the MLP as a nested hierarchy approach and take it rather as a flat ontology, in which the mutually interdependent and interacting categories landscape, regime and niche coexist in and across specific places.

The internal dynamics of this system seem to be particularly dense and diverse in urban contexts where a high number of actor groups interact and co-produce regime and landscape characteristics (see Chap. 3). The resulting local context can either fertilise or restrain niche developments, both within and outside the incumbent regime. Examples of drivers include deliberate and consequent urban policies as they have been implemented and widely supported in Vancouver and Freiburg. Barriers comprise lock-ins to certain routines and standards, for example, when it comes to neighbourhood planning or building permits (see the example of Hollerich Village in Sect. 8.4.1) or when ambitious local regulation is overruled (e.g. Brisbane's sustainable housing code in 2000).

Cities can thus be considered as privileged arenas where all three levels can blend and create a place-specific context, which cannot be ascribed to the landscape level alone. Even though landscape elements exist and interact at a range of geographical scales and might shape particular urban landscape articulations, the landscape level also interacts with a regime that may show local specificities, too. In other words, the established building sector in Vancouver may have dispositions different from the ones in other Canadian cities. Hence both levels are influential as to emerging niches.

Given this narrow interconnectedness of the three levels, cities thus cannot be understood as localised landscapes per se, nor can they directly be equalled to the notion of niche. However, where locally specific landscape and regime elements are

strong (e.g. the Freiburg energy standard together with a certain environmental culture and energy know-how), cities may provide a fertile ground for innovations and may have niche characteristics themselves. The three levels of the MLP thus co-constitute specific and largely place-bound contexts. The inherent dynamics of these contexts and their changing constellations produce a high level of contingency as to the actual trajectories taken in the evolution of the green building sector. Although a certain geographical distinction of green building contexts can be contended, they are not exclusively limited to one particular territory. As the following chapter shows, transitions are shaped by relational influences that involve both local and inward looking as well as external and outward facing processes.

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Chapter 10
Leading the Green Transition?

Abstract Urban green building transitions are driven by experiments and innovations raising questions of drivers and barriers behind these processes. This chapter discusses spatial and temporal perspectives on green building innovations drawing on research on policy mobilities and innovation. It discusses green building in Freiburg, Vancouver, Brisbane and Luxembourg as places of transition where innovations and change are shaped by internal (local) and external (extra-local) factors. Further, it highlights how the nature and objectives of green building have changed over time based on experiments with green neighbourhoods and flagship buildings and describes how green building is increasingly used for competitive positioning, green marketing and city branding. Finally, the chapter discusses the mobility of green building innovations for the four case study regions differentiating between Freiburg and Vancouver that are predominantly characterised by local policies, models and knowledge and Brisbane and Luxembourg that largely draw on external green building innovations. Together, the chapter highlights the value of spatially sensitive analysis of green building transitions.

10.1 Introduction

The case studies of Freiburg, Vancouver, Luxembourg and Brisbane covered in this book illustrate the different strategies and roles that cities play in climate change mitigation. Freiburg and Vancouver are cities where sustainability more generally and green building more specifically have shaped local politics and urban development for the past few decades. Sustainable urban development in the two cities can be characterised by innovations in green building that provide impact beyond the city. The two cities can be seen as leading urban green building transitions even though the scope and scale of their leadership may differ. For example, Freiburg's Vauban neighbourhood with the solar settlement is emblematic in attracting

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Fig. 10.1 Information on the Green Building Audio Tour in the Olympic Village, Vancouver (Photo: Sebastian Fastenrath)

significant numbers of visitors from all around the world including politicians, planners and architects who seek inspiration, ideas, knowledge and models they can take back to, and adopt and adapt in, their home cities (González 2011). Vancouver's Olympic Village (OV) is seen as being similarly novel and ambitious but mostly within the North American context: the OV illustrates how climate change mitigation is showcased using green building features (Fig. 10.1). Whereas Freiburg's Vauban has been described as having been shaped by a very specific context consisting of locally grown expertise and public environmental concerns in particular with respect to renewable energy (see Chaps. 5 and 9; Fastenrath 2015; Fastenrath and Braun 2016), the objectives of Vancouver's OV were also influenced by external visions, including those of the International Olympic Committee (Sect. 6.5).

Freiburg and Vancouver are popularly seen as examples where sustainability is rooted in the local culture and context. Using the multi-level perspective (MLP), the two cities can be understood as niches that foster innovation in green building. Brisbane and Luxembourg, in contrast, are depicted as followers rather than leaders. In and within the two cities, niches emerged more recently and within very different regional contexts. Here, green building is more likely to be adopted and adapted from other places, rather than originally conceived and developed into replicable models for elsewhere. But the two cities nonetheless showcase urban green building experiments and expertise (albeit at a different scale). In the case of Brisbane, the city looks back to early leadership in solar technologies for buildings and more recently features some innovative social housing experiments such as Green Square and Common Ground (Sects. 7.4.1 and 7.4.2). Both cities illustrate how political agendas both hinder and accelerate progress towards green building. While green building in Brisbane is challenged by changing and discontinuous political agendas with sustainability policies being rolled back in recent years, Luxembourg's growth agenda, in contrast, seeks to establish the country as an international leader in the field of green (building) technology—a strategy that the country

applied to the finance sector in the 1990s. Luxembourg's green building projects have been largely inspired by knowledge, practices, standards and models from elsewhere that are being imported and applied to local projects as illustrated by the triple-certified (HQE, BREEAM, DGNB) Solarwind building in Windhof (Sect. 8.3.1).

Leadership is not only characterised by the degree to which it is recognised, copied and adapted by others as illustrated by numerous city rankings and awards. Urban leadership is being claimed by cities with the aim to position themselves, often involving competitive elements. Further, urban green building transitions are not always driven by climate change imperatives focused on reducing greenhouse gas emissions. They also reflect political and economic ambitions to brand the city internationally (e.g. job creation, economic growth). For example, the City of Vancouver actively promotes its Greenest City 2020 Action Plan (GCAP) and measures its performance against other urban climate strategies internationally, not least to position the city as a desirable and liveable place to attract economic investment and skilled labour. Competitive positioning and entrepreneurial interests similarly shape Luxembourg's greening strategy. Flows and connections thus consist not only of the transfer of innovations, knowledge, practices and models through cities and other networks but also of comparative and competitive positioning between cities expressed through neoliberal and entrepreneurial strategies and actions.

This chapter focuses on these connections and flows of ideas, knowledge, models, schemes and innovations within and between places to evaluate the role of cities in green building transitions. It critically analyses aspects of knowledge transfer and learning, green leadership and positioning within and beyond cities. It does so by focusing on spatial and temporal dimensions of greening comparing and contrasting examples from the four cities covered in the book. From a spatial perspective, cities as places of transitions are understood here as multi-scalar and relational. They are shaped by both internal and external influences and speak to internal and external audiences (McCann 2013)—they are not bounded or isolated entities. Yet, cities are frequently associated with locally specific cultures, institutions and other localised characteristics. Leadership is frequently seen as relying on such intrinsic qualities, while those cities following and imitating green leaders are seen as being shaped by models and ideas developed elsewhere (González 2011). This chapter probes these associations with innovation and leadership with locally generated or home-grown strengths. It highlights how objectives, meanings and discourses of greening are relational both across space and time. It hence responds to questions of comparability and transferability and argues for an open engagement with green initiatives that takes into account spatial and temporal relations.

The chapter is structured as follows. The next section focuses on cities as places and spaces of transitions where innovations happen. It describes and compares Freiburg, Vancouver, Brisbane and Luxembourg as different (alternative) milieus (Longhurst 2013) shaped by internal and external factors. Section 10.3 focuses on the temporal dimension and considers how the role of cities may change and transform green building over time. Section 10.4 critically discusses green leadership, marketing and branding as one facet of green building as it emerges from the four case studies. The final section presents a synthesis of mobile knowledge and ideas as they occur in the four case studies.

10.2 Places of Transition

The importance of place in providing stimulus for economic development is postulated across human geography subdisciplines. From an economic and regional development perspective, geographers have studied the factors and conditions promoting innovations. One of the main fields in economic geography relates to understanding the role of innovations for economic growth including new technologies, forms of organisation, management, communication and presentation and to offering insights on drivers and barriers to innovation. Knowledge, learning and other flows between different actors and institutions are seen as crucial in fostering creativity and innovation in certain places (Amin and Cohendet 2004; Bathelt et al. 2016; Boschma et al. 2013). Such research highlights the importance of place and spatial proximity (Boschma 2005; Morgan 2004) as illustrated by work on clusters, creative milieus (Becattini 1991; Camagni and Capello 2002) and institutional thickness (Amin and Thrift 1995). While most of these contributions are concerned with regional contexts, the urban scale is considered pivotal when it comes to framework conditions and cross-sectoral exchange amongst people working in the same city. For example, Florida (2005) sees highly skilled white collar workers as major drivers for economic growth and associates them with urban environments linked to a high density or availability of certain infrastructure (including research, cultural and social institutions). While work on clusters highlights the importance of proximity and hence place in respect to innovation, Bathelt et al.'s (2016) study also emphasises the role of pipelines, which describe knowledge exchange networks between often faraway places that offer inspiration, stimulation and know-how.

While economic geographers have primarily focused on innovation in respect to economic growth, other scholars have focused on the social and cultural context conditions (such as value systems and the existence of organised activism) that favour changes that challenge existing policies and practices as they can be associated with more radical transformations of existing systems (Affolderbach 2011; Marston 2003). Similarly, considerable attention has been directed to the role of place including geographically fixed characteristics. Based on his work on Totnes in England, Longhurst (2013) uses the concept of alternative milieu to describe the development and nature of alternative places. He understands alternative places as those associated with "alternative practices and institutions that emerged from the Counterculture" as a middle-class movement in the 1960s (Longhurst 2013: 2101) but which may take different expressions. Longhurst (2013) suggests five different typologies including alternative pathways that describe the emergence of new, often green, alternative institutions such as green building (understood as going beyond technological greening) as well as alternative lifestyles that can be associated with green building and lived sustainabilities (see Pickerill 2015: for an example on green living). An alternative milieu thus captures "the geographical density of countercultural networks, institutions, groups, practices, and individuals that coexist within and around a specific locality" (Longhurst 2013: 2103). It is the density and diversity of alternative actors, practices and institutions and, in particular, their geographic embeddedness through physical expressions that are crucial. Longhurst

(2013) refers to Amin and Thrift's (1995) concept of institutional thickness that constitutes the self-sustaining character of the alternative milieu. This also includes natural features (e.g. appealing environmental landscapes) which have been ascribed a role in promoting alterity in the literature (Lees 1999; Longhurst 2013).

Recent work emphasising the debordering of models, knowledge, practices and success stories includes research on the role of policy mobility and the transfer, adaptation, mutation and adoption of ideas, knowledge, models and practices from elsewhere (e.g. Peck and Theodore 2010; McCann and Ward 2011; McCann 2011) (see Sect. 3.4). The core argument of this literature is that when urban policies are adopted in other places, they are not merely replicated but are transformed in the process resulting in urban assemblages of local and global aspects. For example, successful greening strategies such as Freiburg's green neighbourhood developments of Rieselfeld and Vauban may act as models for other cities, but *what* is being transferred, deemed appropriate and replicated will differ based on those involved in the process as well as the new context the model is sought to be transferred to. Objectives and meanings may change in the process as well, as policy-makers, planners and other actors discuss, envision and design subsequent policy proposals. The policy mobility literature seeks to reveal these relations that bring inspirations, ideas, interpretations and other influences together leading to new expressions of policies. Rather than contradicting ideas such as the local milieu, policy mobility adds another layer by highlighting the relational character of (local) innovations and knowledge. The local hence consists of both internal as well as external forces and influences.

Freiburg's trajectory of greening has been described by many respondents as influenced by two main local stakeholder groups who were pivotal in driving the green building transition: its residents and its scientific community. A high level of environmental consciousness characterises Freiburg's residents, and the opposition to the planned nuclear power plant in nearby Wyhl has frequently been mentioned in this regard. This opposition to an identified threat to local livelihoods is common in building up local solidarity and shared goals (Devine-Wright 2013). Linked to this, Freiburg has seen the emergence of scientific knowledge communities focused around alternative energy generation. The local energy scene that emerged in the 1970s demonstrated early on that alternatives to fossil fuel and nuclear power were possible.

The narrative around environmental activism in Vancouver presents a similar picture. Vancouver and the West Coast more generally have been associated with the rise of the conservation movement in the 1970s and 1980s (Affolderbach 2008). While British Columbia's economy is largely shaped by the resource sector, respondents ascribed the foundation of Greenpeace in Vancouver, environmentalist David Suzuki and academic thought leaders affiliated with the University of British Columbia (UBC) more influence on shaping the character of the region (Chap. 6). Hence, in both Vancouver and Freiburg, the local milieu is linked to environmentalism as a shared societal value which is promoted and further developed through (research) institutions and scientific expertise. Both regions feature alternative milieus that are associated with narratives of localness: environmental activism, alternative lifestyles and municipal governments responsive to these interests. In both regions, the local milieu is also associated with the surrounding natural setting of the Black Forest in Freiburg and the Coastal Mountains and Burrard Inlet in

Vancouver. Further, and as interview material from Freiburg and Vancouver illustrates, there are discursive effects of local greening that reinforce these alternative tendencies (Longhurst 2013).

In contrast, the case studies of Brisbane and Luxembourg present a different context that could be interpreted as more strongly influenced by external forces. Both city regions have been more characterised by a culture of *resistance* rather than change. Early developments in green building in Brisbane can be traced back to the 1950s and 1960s with emerging research activities at the University of Queensland. While early local expertise was built up, particularly around solar energy and solar building design for tropical housing, it nevertheless remained at the margins. Further developments seemed driven to a greater extent by external factors (including the introduction of energy efficiency standards at the national scale in the 1990s and the 2000 Olympics in Sydney that were promoted as the first green Olympics) and affected by changing governments and political agendas described as flip-flop policies. In contrast to Freiburg and Vancouver, the public was not identified as actor group involved in green building transitions, but rather as resistant to change.

Luxembourg's culture and economy have been depicted as relatively traditional, lacking signs of strong alternative and environmental elements. Perhaps partly due to its relative smallness, connections with and links to other countries and places abroad appear particularly pronounced as expressed through Luxembourg's role as host city of several EU institutions and its role in the global financial and insurance market. Greening efforts appear primarily driven by the national government's interest to boost the country's economic competitiveness and are informed by development strategies employed elsewhere. The public is not characterised as more environmental conscious than in other regions. Contrarily, the large carbon footprint of Luxembourg's residents is linked to its high per capita income expressed in a higher per capita floor area in housing and strong dependence on individual (private) forms of transportation.

In contrast to Freiburg and Vancouver, Brisbane and Luxembourg appear to lack an alternative milieu characterised by spatially embedded actors, institutions and practices but have also witnessed transitions towards green building despite these being more recent than the other two examples. While the former two are associated with local structures that drive and reinforce green building transitions, they are obviously also influenced and characterised by broader processes and events, as emphasised by the policy mobility literature.

10.3 Transitions in Relation

Tracing specific pathways of green building transitions reveals not only the interplay between localised, context-specific influences and external ones; it also adds to a better understanding of how these spatial relations and discourses of greening change over time. As outlined above, the literature places emphasis on geographically

specific influences, in particular local ones that characterise specific places and allow them to innovate and excel. While innovations and the processes of experimenting and testing can be costly and do not always lead to success, cities willing to take the risk gain knowledge, experience and act as models for others when innovations are successful or unsuccessful (Peck and Theodore 2010). Place is hence emphasised as crucial to driving change. Longhurst (2013) argues how alternative milieus are self-reinforcing and are able to maintain their transformative potential. While the examples of Freiburg and Vancouver suggest trajectories linked to locally rooted, early expressions of counterculture and greening, the way greening is perceived, implemented and instrumentalised in the regions differs and has also changed over time. Similarly, Brisbane and Luxembourg that have been characterised by milieus resistant to change have more recently shown interest in and transitioned towards green building. This section discusses some of the changes in understandings and objectives of green building and associated spatial relations.

Table 10.1 provides an overview over selected neighbourhood developments and buildings in Freiburg, Vancouver, Brisbane and Luxembourg. The neighbourhoods of Rieselfeld and Vauban in Freiburg were responses to the city's housing shortage and the need and political will to provide affordable, liveable and environmentally sustainable neighbourhoods that included a range of new building and urban design approaches. These were influenced by local knowledge and expertise and included a transport concept around a tramline and bicycling networks, strict energy building standards enforced through sales contracts of building lots and green zones and spaces, including shared gardens (Table 10.1). Both developments also involved citizen and resident participation. While Rieselfeld placed stronger emphasis on social sustainability including provision of social housing, Vauban focused much more on ecological dimensions of green building through voluntarily imposed strict energy standards that reached passive house standards. The OV neighbourhood in Vancouver was influenced by the 2010 Winter Olympics held in the region both in terms of its objectives and conception as well as the timeline for completion. It was conceived locally driven by the political will to create a sustainable neighbourhood development in Southeast False Creek which predated the bid to host the Winter Olympics (see Chap. 6). The International Olympic Committee heightened expectations in terms of environmental sustainability and the city quickly embraced the idea of making the neighbourhood a model for sustainability.

The examples of Hollerich Village and Solarwind in Luxembourg and Common Ground in Brisbane confirm assumptions that followers draw largely on ideas, inspirations and models from elsewhere. Both Luxembourgish examples illustrate compliance with a number of (strict) certification schemes from elsewhere. Solarwind is a privately developed green office building boasting triple certification. Hollerich Village is a private development proposal for a predominantly residential inner-city neighbourhood envisioning One Planet standards, which were developed by the NGO Bioregional and have been used for the renown BedZED building. The two examples also illustrate the business case of green building—one of the main rationales and drivers of sustainability transitions in Luxembourg. Yet, the examples are

Table 10.1 Examples of innovative building projects in the four case study regions

Project	Size	Timeline	Development	Features
Rieselfeld, Freiburg	~70 ha, 4200 housing unites	1993 start of development, 1996 first units completed	Municipality-owned greenfield (sewage water infiltration) site, mixed-use	Energy building standards, transport concept including central tramline and bicycle infrastructure, shared gardens, green space
Vauban, Freiburg	~38 ha, 1730 housing units	1998 start of development, 2013 completed	Municipality-owned inner-city brownfield site, mixed-use	Central tramline and bicycle infrastructure, building groups, solar settlement
Hollerich Village, Luxembourg	~4 ha	2013 project announced, suspended in 2016	Private brownfield inner-city development, mixed-use, involvement of UK NGO Bioregional (network and label "One Planet") and a number of targeted partnerships with local not-for-profit organisations	To implement One Planet Community principles, low energy targets, walkability, community garden
Solarwind, Luxembourg	~2.3 ha	Opened in 2012	Private greenfield development in industrial area of Windhof involving two real-estate developers and one engineering consultancy, office building	CO_2-neutral, cradle-to-cradle, upcycled fittings and furniture, triple certification (BREEAM, DGNB, HQE)
Olympic Village, Vancouver	~36 ha, ~1100 housing units	First discussed in the late 1990s, completed in 2010	Mainly municipality-owned brownfield inner-city site, mixed-use	LEED platinum for neighbourhood through green technologies, urban design features and district energy (Neighbourhood Energy Utility)
Green Square, Brisbane	80 units	Completed in 2010	Brownfield inner-city site, developed by not-for-profit housing provider Brisbane Housing Company and architects Cox Rayner, part of Brisbane City Council's green urban renewal strategy	Affordable, social housing that also targets homeless people, provision of private and communal space, social service provision
Common Ground, Brisbane	1800 sqm, 146 apartments	Opened in 2012	Inner-city site, developed by not-for-profit Common Ground Queensland following the example of Common Ground New York	Affordable, social housing that also targets homeless people, provision of private and communal space, social service provision

not simply imported models and practices from elsewhere but have been transformed and adjusted to the local context. The examples of Green Square and Common Ground in Brisbane differ, as their primary objective is a social one. Both buildings provide affordable green housing for low-income and disadvantaged people and were created involving NGOs in response to growing concerns around homelessness in the city. Common Ground has been developed to provide housing to the homeless. They also stand out in Brisbane, as green building is typically restricted to office buildings whereas the residential sector has hardly seen any changes.

The examples of neighbourhood developments and building projects suggest that early transitions towards green building are often associated with local institutions, actors and practices as described by the concept of the alternative milieu. But spatial relations are rarely restricted to the local. Green building discourses and roles of green building innovations change over time. External forces may increasingly influence early innovators, while those cities following may develop their own, very specific ways of greening. Freiburg's Rieselfeld and Vauban neighbourhoods were predominantly shaped by local drivers as briefly outlined above but also utilised ideas from elsewhere, as illustrated by the emergence of building groups, a concept that originated in Berlin. Since the conception of the two neighbourhoods, the local character of the developments has changed to a much more global and outward looking role where the two green neighbourhoods are understood internationally as models and best practice examples reflecting the city's greening strategy. As such, Vauban today is known far beyond the region as green success model that attracts international interest. One former member of the Vauban project group stated that visitors

> come from every corner of the world… Visiting delegations from America, Korea, it's crazy where they all have heard about Vauban. […] Last year I was outside [in Vauban] with a group from Switzerland, and on the same day, seven other groups were there too. (Frei18)

While continued international attention attests the success of Vauban as model and inspiration for neighbourhood planning and design, concerns have been raised that elevating neighbourhoods like Vauban to best practice examples may ignore challenges and limitations of the development. Freytag et al. (2014) and Mössner (2015), for example, have raised the question whether Vauban in particular meets its original social sustainability objectives including inclusivity and affordability. There is evidence that green neighbourhood developments are dominated by specific constituencies with a risk of ecological gentrification or greenification that may exclude or even disadvantage other groups (Dooling 2008). Further, the shift in Freiburg's politics from bottom-up to top-down approaches suggests a change in which actors are influencing development in the city.

The OV in Vancouver shows some parallels to the Freiburg examples in terms of its context. Both are situated within places characterised by purported high levels of environmental consciousness but also growth pressures that have led to a housing shortage, both in terms of availability and affordability. In contrast to Freiburg's Vauban, the OV was perceived not only as opportunity to test green innovations but also as an extrospective showcase. It was envisioned as low-carbon and liveable

neighbourhood (in particular to families) that provides open and green space, shops and restaurants together with affordable and social housing, which many felt was undermined by the price of units that were put on the market. Problems related not only to the relatively high costs of housing but also to challenges related to translating green building innovations into practice. In her research on the OV, Westerhoff (2015) gives a detailed account of the lived sustainabilities from the perspective of the residents. She documents how the challenges posed by green building features and technologies from abroad help residents to connect and develop a sense of community. There is evidence here that over the past years, the OV has changed in meaning from flagship development to one that emphasises community life for local residents.

The examples from Luxembourg and Brisbane illustrate how more recent greening is strongly influenced by approaches and models from elsewhere, whether these are certification models or projects (e.g. Common Ground in New York), but also how these have been tailored and changed through local processes. Despite the influences through external models and standards, the cases provide examples of locally produced adaptations. The proposal of Hollerich Village involved participation with local groups to shape the development through engagement with schools, not-for-profits and drop-ins for local residents. The strong role of the private sector, and hence entrepreneurial objectives, also distinguish the cases from those in Vancouver and Freiburg. The two social housing projects in Brisbane highlight social sustainability concerns, which, based on the research presented, appeared to be neglected in the other regions. Green building aspects were seen as a necessity to realise Green Square from an affordability angle:

> We wanted to be near public transport, we wanted to be using less electricity, we wanted natural ventilation […] because we have a low income client group. […] Less car parking, less reliance on the motor vehicle, lower maintenance costs. […] We did what we thought made sense and then we find we are getting all these ticks, you know, against environmental sustainability. (BHC representative, Bris30)

Interestingly, green building here is thought of as complementary and supporting, rather than contradictory, to affordability. However, the volatile political context of green building in Brisbane raises the question whether the lack of green or sustainable residential buildings in Brisbane results in not-for-profit initiatives.

The examples of green neighbourhoods and buildings highlight the interplay between localised, context-specific influences and external ones and how these change over time. Green buildings and neighbourhoods reflect changing discourses of greening—the meaning and objectives of these projects are not fixed. How local residents and groups from elsewhere understand, evaluate and identify with these buildings and neighbourhoods may change. Similarly, earlier innovations and leadership are never solely locally produced. A better understanding of sustainability transitions in green building hence requires the tracing of barriers and drivers—both local and external ones—in much more detail and over time.

10.4 Green Leadership

Green building is now commonly used as strategy by cities that seek to mitigate climate change. But it is not just driven by environmental imperatives. Urban greening and sustainability agendas are influenced by at least two other forces: (1) the need to respond to growing adaptation pressures which may arise, for example, from public pressure, environmental problems or legal requirements (e.g. at higher spatial scales) and (2) the interest in strengthening the city's competitiveness (Affolderbach and Schulz 2017). In that sense, it "has become not only an environmental but also an economic and political necessity" (Affolderbach and Schulz 2017: 677) for cities to respond to these pressures and to position themselves as green cities or even climate change leaders. The examples of green buildings and neighbourhoods above illustrate to different degrees the endeavours of cities to not only reduce carbon emissions but also to improve the image and competitiveness of the city and to be recognised and known for these achievements.

The use of sustainability and greening in city branding and marketing has increased significantly over the last two decades (Acuto 2012; Anderberg and Clark 2013; Andersson 2016; Béal 2011). Being green has become a quality label that stands for better living and is deliberately used in urban marketing and branding strategies.[1] In respect to urban policies, McCann (2013: 9) introduces the notion of policy boosterism defined as

> the active promotion of locally developed and/or locally successful policies, programs, or practices across wider geographical fields that can then be used to promote local strategies within policy making communities to boost the reputation of the city as well as stakeholders involved in the policy process.

Green marketing, city branding and boosterism are usually outward facing as they seek to present a place in a certain way as expressed through competitive positioning and measuring at the international scale. This *extrospective* dimension is directed at potential investors, (policy-)tourists and other visitors, policy-makers at different spatial scales and members of specific knowledge communities (McCann 2013). But political endeavours to establish cities as green leaders frequently involve introspective goals that can be aligned with "a multitude of stakeholders and audiences" within the city (Cidell 2015: 567). These are directed at residents and other local constituencies with the aim to increase the identification with and support of these strategies.

Scholars have highlighted ambiguities in the use of the concept of sustainability and highlighted the risks of very different forms and politics of its interpretation and implementation due to the elasticity of the concept (Lombardi et al. 2011; Waas et al. 2011; Hopwood et al. 2005). This similarly relates to concepts of green building where stated objectives emphasise environmental goals (frequently in the form

[1] Marketing and branding are frequently used interchangeably but differ in meaning. Marketing consists of strategies and tools to raise the visibility of a city (like in product marketing); branding seeks to assign a particular image to a city (like the branding of a car manufacturer).

of quantifiable measures such as carbon accounting) and economic growth at the expense of broader environmental and social objectives including in particular aspects of affordability. Studies by While et al. (2004), Long (2016) and others have illustrated how urban greening strategies are hollowed out or changed to cater towards specific interests. Béal (2011), for example, describes how this form of roll-out environmentalism is dominated by certain urban oligarchic groups consisting of urban elites and entrepreneurial actors but excludes other, mostly disadvantaged or silent groups. There is growing evidence that urban sustainability and greening strategies are being used to increase liveability and to boost economic competitiveness and well-being but that benefits and costs of such actions are uneven. This is particularly problematic as objectives of greening and sustainability often provide justifications for development strategies.

Green building transitions in the four case study regions are driven by endeavours to brand and position the cities as green and hence attractive locations for both local businesses and residents as well as external investors, skilled workers and visitors but to different degrees (see Table 10.2). In Freiburg and Vancouver, there has been a shift in objectives and rationales behind greening endeavours from more inward looking, locally produced strategies described above towards much stronger extrospective perspectives over the past two decades. These are largely driven by the municipal governments. As discussed in detail in Chap. 5, Freiburg is branding itself as the Green City which offers a number of successful examples to reconcile soft ecology with hard economics (FWTM 2014). Neoliberal objectives of greening are expressed through expected growth in renewable energy and green technologies, increased tourism through the green and liveable image of the city. The same rhetoric and thinking is evident in Vancouver as, for example, expressed in the Greenest City 2020 Action Plan, Vancouver's greening strategy that seeks to position Vancouver as world leading city in respect to climate change mitigation and social sustainability (Sect. 6.6; Affolderbach and Schulz 2017; Holden and Larsen 2015). The emphasis on competitive positioning and international rankings risks changing priorities of greening from original outcomes focused on sustainability and greening to ones focused on highest competitiveness as measured through quantifiable approaches. The latter may motivate cities to chase for numbers following the mechanisms of ranking or certification tools (e.g. when focusing on highly weighted indicators to the detriment of other crucial dimensions). In both cases, the shift towards more extrospective strategies is expressed through neoliberal and entrepreneurial aspects of greening as well as an increase in approaches using quantifiable measures for comparability such as carbon accounting.

Luxembourg's greening endeavours are much more recent and are characterised by a similar political will to position the city and country internationally to attract investment in the green economy in order to diversify and strengthen the national economy (Table 10.2). Greening in Luxembourg consists primarily of technological fixes in respect to reduced energy consumption through energy requirement targets introduced over the past 10 years. Aspects of lived sustainabilities linked to changes in consumer habits and broader social changes only occur at the margin and do not feature in the dominant debate. Introspective dimensions of the new political

Table 10.2 Dimensions of green leadership in Freiburg, Vancouver, Brisbane and Luxembourg

	Dimensions of greening	Expression of leadership	Introspective dimensions	Extrospective dimensions
Freiburg	Originally developed as bottom-up, community interest; since the 2000s top-down and increasingly neoliberal logics and city marketing driven by the city government	Expertise on alternative energy and energy reductionand other dimensions of green building in (1) neighbourhood design, (2) technologies and (3) policy frameworks	Participatory planning and development (bottom-up), liveability through healthy and affordable neighbourhoods	Attractive place to visit, live and invest in, profitable environment for energy efficiency and other green technologies
Vancouver	Originally developed within the context of liveability, since the 2000s increasingly neoliberal and entrepreneurial objectives as expressed in endeavours to position the city internationally	Quantifiable and comparable measures of greening including the GCAP and OV which allow comparison and relative ranking with other cities around the world	Participatory planning, increased liveability through healthy and affordable housing as well as green jobs, investments and revenues of the local economy	Attractive environment for external investment in the green economy, desirable destination for tourists and visitors
Brisbane	Entrepreneurial—business-driven (but earlier government support), non-profit involvement for socially inclusive residential developments (Common Ground and Green Square)	Weak and primarily through Green Star certification in the commercial sector with little sign of change in the residential sector	Weak and subject to flip-flop local and state-level sustainability politics	Largely market driven through increased returns on green building for commercial buildings but weak in the residential sector due to changes in local and state-level sustainability politics
Luxembourg	Entrepreneurial/economic competitiveness around energy efficiency and security and economic diversification	Regulation focused on low energy building and adoption of international standards and measures Technological resourcefulness (smart buildings, circularity, energy-efficient technology)	Economic growth, quality of life, energy security, employment	Green technology, incentives for investors in particular sectors (e.g. circular economy, eco-building, sustainable mobility), employment

positioning relate to issues of energy dependency and security, employment generation together with increased liveability and sustained economic growth. Green building transitions in Luxembourg are also driven by private initiatives emphasising the entrepreneurial dimension. Respondents suggested that green building allows increased economic returns. While green technology may be more expensive, green buildings in Luxembourg can be easily sold at a premium rate, which helps strengthen the business case of greening.

In contrast to the other three cities, and since the election of a new council in 2008, Brisbane City Council is not currently the core driver of greening in the city. While the 1990s and 2000s saw a progressive council in terms of greening that introduced, for example, financial incentive schemes for green building and the Plan for Action on Climate Change and Energy released by the Council in 2007. The latter includes similar objectives of community engagement and liveability as Vancouver's GCAP. Green building has also been largely driven by the supra-regional Green Star building rating system, which was introduced in 2002. Green building in Brisbane exists as a business-driven phenomenon in the commercial building sector paired with the niche examples of not-for-profit collaborations mentioned above. These illustrate that despite, or maybe because of, the lack of political will, there *is* room for experimentation that allows sustainability debates to refocus around social inclusivity and provisioning of affordable housing away from neoliberal agendas and carbon calculus.

10.5 Mobile Greening

The four cities present different transition pathways of green building that illustrate the relational character of local greening. Green building transitions can also be analysed based on the different articulations, adaptations and assemblages of policies, models and knowledge across space. Table 10.3 provides a list of characteristics of mobile models, policies and knowledge for each of the case study regions but does not claim to be exhaustive. Local projects, innovations and ideas can offer learning opportunities and models for elsewhere. While Freiburg attracts interest from around the world, Vancouver's role as leader is largely restricted to the North American continent despite its claims of global leadership. Brisbane and Luxembourg largely adopt and adapt practices and knowledge from elsewhere but remain primarily influenced by the national (Australian) and European context.

Green building innovations that can be mobilised and transferred or that have been imported, influenced or adapted from elsewhere are distinguished into three categories (Table 10.3): (1) policies, regulations and strategy papers as discussed in the policy mobility literature, (2) models that encompass all non-policy related innovations including buildings and neighbourhood developments, organisational, institutional and other arrangements such as certification bodies and (3) locally held and generated expert knowledge and experience mostly related to embedded

Table 10.3 Characteristics of mobile policies, knowledge and practice exchange in Freiburg, Vancouver, Brisbane and Luxembourg

	Spatial scale	Policies	Models	Knowledge/ expertise	Key institutions and actors
Freiburg (Chap. 5)	Global, predominantly provision of models and knowledge	Energy Standards (e.g. Freiburg Standards, Passive House), large-scale neighbourhood planning	Solar Settlement≫ Vauban≫ Rieselfeld≫ Buggie 50≫	Renewable energy since the 1970s, public participation	Municipal government, civil society through building groups, energy scene, institutional actors such as Fraunhofer Institute, Freiburger Stadtbau
Vancouver (Chap. 6)	North America, both provision and adoption and adaptation of models and knowledge	Greenest City 2020 Action Plan, Building Codes	Vancouverism≫ CityStudio≫ Olympic Village≪≫ Flagship buildings≪≫ LEED≪	Urban design, public participation	City of Vancouver, University of British Columbia, Canadian Green Building Council, utility companies, thought leaders, public
Brisbane (Chap. 7)	Australia and New Zealand, mainly adoption and adaptation of models and knowledge	Plan for Action on Climate Change and Energy	Green Star≪ Common Ground Brisbane≪ Brisbane Square≪ Global Change Institute≪	Solar energy and solar building design since the 1950s, architecture (e.g. Steven Szokolay)	University of Queensland (e.g. solar energy and subtropical building design), local government (1990s/2000s), private investors, not-for-profit sector (as niche actor), state government during different periods
Luxembourg (Chap. 8)	Western Europe, mainly adoption and adaptation of models and knowledge	National and EU energy standards, green growth Leitbilder (circular economy, eco-technologies, third industrial revolution)	Certification schemes both national (LENOZ) and international ones≪ Neobuild ≪≫Solarwind≪ Hollerich Village≪	High level of adaptability and openness to foreign and international standards and best practices	Luxembourgish government, private investors, not-for-profit organisations

≫ models that can be mobilised and transferred elsewhere, ≪ models that have been adopted and adapted from elsewhere, ≪≫ both

institutions and alternative milieus. As discussed above, all of these are understood as relational processes, hence never just local nor exclusively from elsewhere.

In terms of policies, Freiburg's energy standards have been frequently highlighted as crucial to the city's transition in green building. The same applies to Vancouver's building bylaws. Models of green building are most visual in building experiments and flagship developments. Rieselfeld and Vauban are emblematic for new neighbourhood developments that are largely seen as successful models to be replicated or inform developments elsewhere. Vancouver's Olympic Village is both an example of imported practices and knowledge as well as inspiration for new developments. Freiburg also provides pioneer projects for retrofitting (Buggi 50).

Certification standards have played a central role in establishing and communicating green building in Vancouver, Brisbane and Luxembourg and to a lesser extent in Freiburg (e.g. passive house standard) and have been widely adopted and enshrined in local policies and regulations. Most certification standards are designed within specific context (e.g. Australia and New Zealand for Green Star, North America for LEED, see Table 6.1) but provide a high level of mobility and transferability. There is, however, growing criticism related to measurable and quantified approaches. Both in Vancouver and Brisbane, respondents questioned whether LEED and Green Star, respectively, delivered highest standards and best outcomes. The certification tools only measure what they are designed to measure and may restrict experimentation and endeavours to push set boundaries. Respondents shared concerns that the certification schemes resulted in a measurement of compliance with set standards rather than measurement of greening in terms of reducing negative environmental, social and economic impacts and optimising gains. This translated into a tendency to chase points and changes the core of green building objectives from achieving best outcomes to compliance with set targets and regulations.

In terms of locally generated or held knowledge, expertise and experience, Freiburg and Brisbane share know-how focused on energy-efficient technologies which are largely associated with universities (Brisbane) and research institutions (Freiburg) as well as a number of key individuals. It is the context, particularly in political terms, that has led to a durable knowledge community in Freiburg, while Brisbane's changing environmental politics seem to have destabilised the knowledge cluster. Vancouver's leadership in green building is probably most strongly expressed in the area of urban design. This is reflected through the urban form described as Vancouverism but also through dedicated groups working on holistic approaches to neighbourhood design within the City of Vancouver and UBC. Vancouver also boasts experience with public engagement and collaborative approaches to sustainability. Luxembourg seems to lack locally anchored know-how related to green building. This can partially be explained by the relatively small size of the country but also by its industrial legacy. However, recent efforts to invest into public and private research (e.g. through the creation of a university and dedicated research centres) aim at improving the country's knowledge base. More generally, Luxembourg has proved a high level of adaptability and political will to offer

economic opportunities for highly specialised sectors that is now directed towards green technologies and building.

One last aspect that has been neglected from a transition studies perspective relates to actors as carriers and drivers of knowledge and change. Table 10.3 identifies a number of key institutions and actors that underline the interplay of government, private and community actors. The analysis of the four cases highlighted the centrality of individual actors as thought leaders and innovators in particular during periods and in regions with high levels of innovativeness. In Vancouver and Freiburg, green building experiments have been strongly associated with a number of key individuals. Early experiments in Brisbane were equally linked to a few experts, while recent flagship developments in Luxembourg have been conceived and developed by dedicated private investors. These individuals have been equally central to the development and generation of green building policies, models and knowledge emphasising the role of actor-centred and qualitative research in understanding sustainability transitions.

Analysis of spatial and temporal dimensions can enrich our understanding of green building transitions. Spatially sensitive and actor-centred analyses in particular and as promote in the policy mobility literature contribute to a more nuanced understanding of processes of learning, adaptation and mutation and the role of individual actors and actor groups. They also help to understand the relational character of localised processes of innovation. Green building transitions are temporal processes, and a focus on spatial dimensions provides insights into broader trends and changes over time. Based on the findings from the four case studies, green building transitions have changed in nature and objectives. All four cases revealed a shift towards more competitive approaches of greening linked to target-based, quantitative approaches to reduce carbon emissions, economic opportunism and growth imperatives and a neglect of social dimensions of greening where social sustainability can be seen as a niche phenomenon within the green building sector. Generally, and in line with other findings in the literature (e.g. Gibbs and O'Neill 2015), green building transitions in Freiburg, Vancouver, Brisbane and Luxembourg suggest incremental rather than radical change.

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Chapter 11
Conclusion

Abstract This concluding chapter highlights the main findings of the GreenRegio research project by presenting the core results and by discussing their relevance for conceptual debates around urban sustainability transitions in general and theory building in transition studies in particular. It also illustrates the major shortcomings of the research design and indicates possible biases and neglected dimensions. Finally, it outlines a series of future areas of research and prospective fields of inquiry.

11.1 Core Findings

This book has focused on different forms of innovations (including technological, organisational and social ones) related to green building endeavours and has inquired into the context conditions prevailing in Vancouver, Freiburg, Luxembourg and Brisbane. Case studies of innovations involved existing and new buildings and neighbourhoods but also policies and institutions. Without reifying the respective urban settings as sole determinants for greening processes in the building sector, the findings reveal a number of situated trajectories, including strong legacies of the past which can act both as promoters and barriers to green building transitions. Barriers only partly result from adverse localised context conditions as, for example, illustrated by the political context in Brisbane and social resistance to change in Luxembourg. Rather, they are influenced by a highly complex, multi-level range of factors, both from inside the respective local setting and from outside, often including global flows of knowledge and inspiration, institutional pressures and power dynamics.

The multi-level perspective (MLP) provides a heuristic to scrutinise the individual city-level contexts regarding their political, socio-economic and cultural dimensions. The perspective helps identify a series of place-specific factors, but these can only be understood from a relational perspective that is by including external factors and triggering or obstructing local trajectories. While this becomes most obvious at

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the landscape level where national economic and demographic development (e.g. growth pressure), global political imperatives (e.g. climate change mitigation) or sociocultural trends (e.g. lifestyles and consumption patterns) may have a strong impetus on the evolution of green building, it becomes more obscure for the actual relationships at the regime and niche levels. Here, the role of individual actors as carriers of knowledge paired with the agency of practices, routines and thus institutions seems to play a pertinent role even though more difficult to empirically assess. Vancouver's Greenest City Action Plan and Freiburg's Vauban neighbourhood consist of ideas and knowledge from elsewhere that have inspired and shaped green building. Local models and practices thus consist as much of external as of internal influences.

The concept of the niche level and its articulation with the regime level has been strongly debated in the literature. The findings presented in this book suggest that cities themselves, here to be understood as the local context and not as the public authority (e.g. city administration or council), can hold inherent niche characteristics through the favourable environment they provide for advances in the green building realm. Moreover, local context conditions vary over time, as visions, objectives and meanings shared by pertinent actors change over time. That is, windows of opportunity for certain innovations, experiments and pioneering projects emerge and close sometimes within a rather short and defined timeframe, for example, where limited availability of certain incentives and regulations such as fixed feed-in tariffs for renewable energy determines take-up and implementation of green building innovations. Further, the regime level, despite its suggested relative stable character, emerged as a continually evolving system strongly affected by landscape impetus but also by its internal dynamics and agency patterns. The four assessed case study regions are characterised by strong local landscape and regime elements, often narrowly interacting with fertile niche initiatives. In certain cases, alternative milieus (Longhurst 2013) provide particularly advantageous context conditions and embrace niche characteristics themselves.

In accordance with Geels (2011), the MLP concept should not be interpreted as a nested hierarchy, neither in the sense of levels of governance or power relationships nor in the sense of a spatial hierarchy (e.g. geographical scales or territorial authorities). Rather, urban green building transition processes should be understood as flat ontologies of closely interrelated systems of agency. These systems articulate contingently in a given city but are not bound to the local context alone. On the contrary, and as discussed in Chap. 10, there is strong evidence for both the importance of external inspiration, knowledge transfer and adaptation pressure (inward and introspective dimension) as well as for the effects green building innovations may have beyond the city (outward or extrospective dimensions).

Many of the micro case studies presented in the book show how ideas, standards or even motivations were imported from other contexts, in more or less explicit or subtle ways. The most purposeful attempts to learn from the best involve various types of fact-finding trips, best practice studies, conference participations, invited expert workshops, individual contacts and counselling requests. An important role can also be conceded to the application of international norms and standards (e.g. the

flourishing of green building certificates). While these external impulses may be key to the successful launch of activities and may trigger further iterations of a particular evolution, they bear the risk to temper aspirations and innovativeness (e.g. when only compliance with established and certifiable standards is aimed for instead of trying to move set boundaries with more ambitious goals). Also, the possible overrating or single-sided presentation and perception of vanguard projects such as Vauban in the international community of practitioners and academic scholars (partly co-constructing a myth through rather superficial assessments) implies that potential challenges or shortcomings may be overlooked often relating to social dimensions of green building endeavours.

Success stories of pioneering cities not only resonate in other places aspiring for similar trajectories. Cities increasingly use green building achievements in their strive for competitiveness. Positions in relevant national and international rankings and award schemes (e.g. the European Green Capital Award from the EU Commission) as well as explicit ambitions in midterm strategies (e.g. Vancouver's Greenest (sic!) City Action Plan) provide evidence for growing intercity competition and city boosterism (McCann 2013). City makers not only use green building successes and high rankings to underline their acknowledgeable achievements for marketing purposes but as part of a city branding that primarily sells sustainability as an element of liveability and reputation, seeking to attract new talents and investors. In extreme cases—admittedly regretted by some local experts involved—the short-term objectives of a city's sustainability policy may tend to be more oriented towards fulfilling benchmarks of evaluation schemes rather than to follow more comprehensive goals.

Overall, the transition pathways can be understood as the result of a nuanced multi-level and relational pattern of structure and agency, providing incremental rather than radical or disruptive innovations. Context matters as it is influential in nudging or facilitating innovations, but it is not necessarily determining specific outcomes. Context is serendipitous in terms of temporal and spatial variety but also regarding thematic priorities, which is here interpreted as *contextualised contingencies*. Contextualised contingencies reduce the risk of deterministic hypostasising of explanatory factors but seek to grasp the specific characteristics of each city's transition biography.

11.2 Study Limitations

The empirical research design and its practical execution faced a series of material, budgetary, topical and practical constraints. While the more methodological limitations and possibly resulting biases are outlined in Chap. 4, three challenges are highlighted here as they are relevant to understanding the results of this study and indicate further research needs (Sect. 11.3).

First, and although the role of individual actors and thought leaders initiating and promoting vanguard projects was identified as being crucial for innovative

trajectories, a more detailed tracing of the agency of actors was not possible within the research design. Only fragmented evidence emerged from single cases (e.g. key individuals in Vancouver and Freiburg). A valid analysis requires a far more sophisticated and systematic approach, for example, building on suggestions made by McCann and Ward (2012) in their plea for more thorough analyses of the spatialities of policy-making.

Second, transition studies are inherently historical as they are focused on diachronic, longitudinal analyses of economic development trajectories. Despite efforts to assess the early stages of green building policies, partly going back to the 1960s and 1970s, the time span covered is comparably short, and all data was collected over the relatively short time span of two years. Moreover, it remains questionable whether it might not be too early to assess this emerging sector with a transition framework, at least if the latter is understood as an ex post approach. However, the strong situatedness of the emergence of green building in the case study regions to date suggests that even these early decades of green building policies provide substantial findings and allow certain generalisations.

Third, the maybe most problematic limitation of the research presented is its exclusive focus on industrialised countries in the Global North. Even though diversity in the sample is given through varying climate conditions, building standards and traditions, user attitudes, governance systems and macroeconomic path dependencies, the group of cities is relatively homogeneous compared to the challenges cities are facing in other parts of the world. In particular, the socio-economic conditions, growth dynamics, building cultures and other factors are considerably different in many cities of the Global South. It was mainly for reasons of comparison that the sample was confined to Europe, North America and Australia even though this limits the validity and generalisability of the findings significantly. Cities in the Global South are crucial to mitigating climate change globally. They are also places of social and other innovations including decentralised, low-energy solutions and microfinance schemes that can inspire policies in the Global North. There is hence a research need to identify urban green building innovations in the Global South and opportunities and patterns of knowledge mobility with other cities (see also Robinson 2016).

11.3 Avenues for Future Research

The findings on urban green building transitions point to a number of research fields in addition to the indicative research needs outlined in the preceding paragraphs. One perspective deliberately omitted for reasons of practicality and resources available is that on and of the users of green buildings. Their role can be crucial as both owners and tenants influence the actual efficiency of green building investments (Pickerill 2015, 2017). Technology-supported passive houses, for example, require a particular sensitivity of the residents in order to valorise the confined energy at best. This can be particularly challenging when tenants of residential buildings lack understanding of the particular requirements of their building.

The role of urban infrastructures as pivotal underpinnings of green building ambitions was also largely left out from the study. Technical infrastructures here include public transport facilities and aspects of walkability and cyclability of neighbourhoods, energy provision (e.g. district heating), sewage systems, rainwater collection, organic waste recycling, shared community facilities, etc. All these realms have to be seen in their articulation with the green buildings and neighbourhoods as they can predetermine the building design and can contribute to the overall performance of the built environment.

One challenge that emerged out of all case studies is related to the relatively high costs of green building as, for example, highlighted by Brisbane's residential sector or in the increasing opposition against Freiburg's high energy standards. Even though it can be questioned whether additional costs of greening is the most important trigger for real estate price development (e.g. compared to the effects of speculation, privatisation of social housing, rising living standards, etc.), they not only cause debates within academic and policy circles but also impact on residents' lives. The expulsion and replacement of lower income classes through a greenification (or greentrification) of the housing stock increases social and spatial inequalities beyond city boundaries. Moreover, resulting residential patterns have knock-on effects on land use patterns, individual mobility, transport infrastructure needs, employment opportunities and energy consumption, for example, where previous public transit use is replaced by a dependence on individual car commutes. More generally, the social, cultural and demographic determinants of green building approaches require further attention.

Two further thematic areas deserve more attention which currently mark political as well as scholarly debates: the notion of the smart city and the circular economy concept. Both are gaining momentum in the green building discourse and may offer promising solutions but also contain possible pitfalls. If the idea of smartness is narrowed down solely to as is frequently the case, the use of digital infrastructures such as smart grids or communicating household devices (*Internet of things*), it tends to promise technology-based efficiency gains in green buildings without interrogating overall resource needs, production and consumption patterns or potential rebound effects (let alone aspects of data security).

Unrelated to the digital monitoring of material and energy flows propagated by the smart city approach, the notion of the circular economy has recently undergone an impressive renaissance when the EU and many of its member states incorporated it as a core concern of future resource policies and economic restructuring. Based on industrial ecology and symbiosis concepts debated since the early 1990s, its current iteration is strongly motivated by new technological means to ease the sharing and reuse of resources and infrastructures. In its mainstream understanding, it shows strong similarities with soft forms of greening. These involve mainly technology-driven and efficiency-oriented aspirations for an ecological modernisation that does not challenge the core principles of the predominant growth paradigm. Independent of this scepticism regarding their interpretation, both concepts bear potential for advances in the green building sector and have become increasingly central to related debates. Their potentials and effects should be systematically assessed in future research on green building innovations.

Finally, the research presented in this book confirms the necessity to further debate the underlying conceptual approaches and to scrutinise possible readjustments. This applies in particular to further adoptions of the MLP. While the conceptualisation of its diachronic perspective and its focus on the interplay of institutions, structures and agency is advanced, discussions about how to integrate the various forms of spatial interrelations at and across the different levels are only emerging. An explicitly *spatially relational MLP* informed by insights from the policy mobility and relational city literatures offers promising avenues. As illustrated by the findings presented in this book, it is the exchange, transfer and adaptation of knowledge and ideas across space that help unravel the drivers behind green building transitions. It also sheds light on policy failures, knowledge and ideas that do not travel and those excluded from the making of green building policies and practices. This is particularly central to efforts that seek to establish more radical changes that challenge the existing status quo of urban living and may very well be inspired by marginal and alternative knowledge, ideas and practices including those from the Global South. Hence, research on green building undoubtedly provides a very fertile ground not only for revealing pertinent evidence about the success factors and impediments of sustainability transitions but also for pushing the boundaries of related conceptual debates in geography and neighbour disciplines.

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Correction to: Green Building Transitions: Regional Trajectories of Innovation in Europe, Canada and Australia

Julia Affolderbach and Christian Schulz

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The original version of this book was inadvertently published with incorrect placement (on the cover) DFG and FNR logos. The current version of the book is updated with the DFG and FNR logos in correct place that is in Front Matter along with the following note: "Research supported by the Luxembourg National Research Fund (FNR - 5791578) and the German Research Foundation (DFG - BR 1678/12-1)"

P 5 - Captions of Fig. 1.1: Replace ". Photo courtesy of …" by "(Photo: …)"

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P 204 Caption of Fig. 10.1: Remove “Courtesy of”

P 74, 106, 163 Fig. 5.3, 6.4, 8.2: Are these readable in the final book format, or should they be rotated into landscape format?

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Glossary

Alternative milieu The term is used to describe places and spaces that oppose or replace dominant economic (and socio-political) systems (the mainstream) which are often thought of as alternative. These include but are not restricted to green institutions and lifestyles.

Assemblage See urban assemblage.

ASHRAE The *American Society of Heating, Refrigerating and Air-Conditioning Engineers* (ASHRAE) is an organisation devoted to the advancement of indoor environment control technology in the heating, ventilation and air conditioning (HVAC) industry. Founded in 1894, one of its main missions is to promote research and development in efficient and environmentally friendly technologies. For that, ASHRAE provides educational information, courses, seminars, career guidance and publications to professionals as well as the general public.

BedZED The Beddington Zero Energy Development, commonly known as BedZED, is a mixed-use green neighbourhood in Wallington, a suburb south of London, which was completed in 2002. It was developed by Bioregional and is internationally renowned as a pioneer project.

Boosterism The usually enthusiastic promotion of an idea, strategy, image or place. In the context of urban sustainability transitions, boosterism refers to the promotion of cities or specific places within cities as successful examples of being green or sustainable.

BOMA BEST This is the leading environmental certification programme for commercial buildings in Canada. It was launched in 2005. There are six key areas of environmental performance and management embedded in the BOMA BEST assessment programme: waste, energy, water, pollution, indoor environment and environmental management system.

Branding See city branding.

BREEAM This acronym stands for the Building Research Establishment Environmental Assessment Methodology, a sustainability classification of buildings that was launched in the UK in 1990. BREEAM has rapidly become a

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paragon of addressing green building practices with more than half a million certificates delivered in 77 countries (as of June 2016). Components used in the measurements of performance include aspects such as energy, water use, pollution, transport, materials, waste, etc. Leadership in Energy and Environmental Design (LEED) is the North American equivalent to BREEAM.

Buggi 50 Located in the Bugginger Strasse 50, in Freiburg's *Weingarten*-West neighbourhood, Buggi 50 is the first retrofitted high-rise residential building worldwide that meets the *passive house* standard. Initially built in the 1960s, the 16-storey building retrofit is part of a large-scale urban renewal project in the district and was completed in 2011.

Building codes The regulations and rules defining standards for buildings (and nonbuilding structures).

Building group (German: Baugruppe) A collaborative of individuals who jointly design and develop plans for their building block or complex. The self-builders usually hire professionals including architects and builders to realise their plans. Building groups emerged in Germany and have become more widely known as part of Freiburg's Vauban neighbourhood.

Bylaws Regulations passed by local authorities or corporations.

Carbon control The endeavour by authorities at different spatial scales (including municipal authorities) to account for and reduce carbon emissions within their jurisdiction or an otherwise defined entity. These often involve clearly set carbon emission targets that are sought to be met through regulatory tools as well as incentive-based strategies.

Certification Usually a third (independent)-party attestation of a building (or other feature or aspect) to a set standard or quality.

Christiania A green and car-free neighbourhood in Copenhagen established in 1971 and often associated with the alternative lifestyle of its alledgedly autonomous inhabitants.

Circular economy A circular model of production and consumption that seeks to extend product or service life cycles by keeping resources in use for as long as possible and by reusing, recovering and regenerating products and materials at the end of their life.

CIRS The *Centre for Interactive Research on Sustainability* (CIRS) is an interdisciplinary research centre located within the Point Grey campus of the University of British Columbia (UBC). Opened in fall 2011, CIRS's main focus is to explore the role of buildings in maintaining environmental integrity and human well-being and on advancing innovation in sustainable technology and building practices. The CIRS building has been certified LEED Platinum by the Canada Green Building Council and had demonstrated its potential of becoming a living laboratory for sustainable design and construction.

City branding City branding and city marketing are often used interchangeably but the terms differ in meaning. City branding is the process of creating and assigning a certain image or set of associations to a city (comparable to branding by car manufacturers).

City marketing The process of making a city more visible and attractive similar to product marketing. Marketing usually addresses a range of audiences from investors, governments and residents to future employees and tourists.

Common Ground A supportive social housing development in Brisbane focused on people with low income and mental health issues and those who are homeless. Built in 2012, the complex provides a combination of safe housing and in-house support services but also adopted sustainable building principles around energy and water efficiency.

Creative milieu Describes the socio-technical context within which innovative activity is embedded. Creative milieus are associated with presence of certain economic, social and political institutions, knowledge and know-how developed locally over time between a group of actors and conventions (taken-for-granted rules) which often are understood as untraded interdependencies.

Delphi method Originally developed as a forecasting method where a panel of experts is involved in a series of systematic questionnaires to determine, for example, most likely scenarios or most relevant factors. In the social sciences, it is also used to confront panellists with preliminary research results for validation and critical feedback.

EcoDensity A 2006 planning initiative by the City of Vancouver, which sought to achieve sustainability, affordability and liveability through densification within the city. The initiative suffered from the unpopularity of the idea of densification with the public.

Ecological modernisation An approach to greening focused in particular on production processes that are based on the belief that technological innovations will solve environmental problems without compromising economic growth objectives.

Energy plus houses Produce more energy from renewable energy sources that they consume over the course of a year.

Freiburger Stadtbau The municipal property developer and main housing provider in Freiburg. The Freiburger Stadtbau has a long tradition of municipal interventions in housing policy and provision of social housing since the mid-nineteenth century. Plans to privatise the Freiburger Stadtbau around 2000 were met by public opposition preventing the sale.

Green building In the context of this book, green building encompasses a vast array of activities, ideas and strategies related to the conception, planning and operation of buildings that make their construction and use more sustainable. This involves factors and measures leading to higher resource and energy efficiencies (e.g. technologies, decreased floor area per person), to healthier work and living environments contributing to the well-being of users and residents (social integration, shared living spaces) as well as to a better functional integration into the built environment and its infrastructure, in particular regarding aspects of mobility and accessibility.

Greenest City (2020) Action Plan The City of Vancouver's greening strategy that was introduced in 2011 and foresees a reduction of CO_2 emissions by 33% below 2007 levels by 2020 and full reliance on renewable energy by 2050. The plan

consists of ten goal areas that are further defined by a number of targets that are reviewed annually.

Greenification or greentrification A form of gentrification where urban neighbourhoods are upgraded and changed following environmental sustainability objectives. These changes are seen to impact on residential and business uses through increased land values and a resulting replacement of existing residents through more affluent groups and businesses.

GreenRegio The acronym for the research project "Green building in regional strategies for sustainability: multi-actor governance and innovative building technologies in Europe, Australia and Canada" co-funded by the FNR and DFG which provided the findings presented in this book.

Green Square A social housing complex offering in-house support services for its residents including marginalised groups such as previously homeless and mentally ill people. The building design involved green building approaches in particular focused around water and energy savings.

Green Star Launched by the Green Building Council of Australia in 2003, Green Star is a well-established international sustainability rating system for buildings and communities. Green Star rating provides a framework for green building practices. Through a documentation-based assessment, a panel of sustainable development experts rates the environmental efficiencies of buildings. Similar building sustainable assessment tools are recognised worldwide, such as LEED (North America), BREEAM (UK) and CASBEE (Japan).

Hammarby Sjöstad A green neighbourhood in Stockholm, Sweden, which ranks amongst the most commonly referenced and visited green neighbourhood developments in the world.

Heliotrope Built in 1994 by the architect Rolf Disch, Heliotrope is the world's first energy autonomous solar home and rotating solar house. Designed to use the sun's energy by turning a large multidirectional solar panel array on the roof tracks of the cylindrical building towards the sun in different seasons, the building is emissions-free and CO_2 neutral. This system powers a unified climate and floor warmth system, and a rooftop collector traps and filters rainwater. This has become over time a much visited and award-winning pioneering and model project for sustainable residential innovation.

Hollerich Village A privately planned neighbourhood development on a centrally located brownfield site in Luxembourg City. The project is currently on hold but is inspired by both environmental and social sustainability ideas.

Innovation Usually meaning a new idea, method or product. In the book, innovations comprise not only technological but also social, organisational and institutional innovations that may be new within a certain context or that have been adapted or changed from existing ideas, methods or products.

Institutional thickness A term developed by Ash Amin and Nigel Thrift to describe a certain density of institutions that are supportive of and trigger economic activity and growth. These may include government institutions, research institutes, trade associations but also less formal aspects including unwritten regulations and agreements.

Landscape The highest of the three levels of the *multi-level perspective*, which captures the overarching socio-technical context that sets the regulatory, political, cultural and environmental conditions for a particular sector or activity.

LEED or Leadership in Energy and Environmental Design A certification scheme by the US Green Building Council for new buildings and neighbourhoods which is mostly used in North America.

LENOZ A voluntary sustainability certificate for residential buildings in Luxembourg (Lëtzebuerger Nohaltegkeets-Zertifizéierung). The owners' costs for undergoing the certification procedure is subsidised by the government. In 2017, subsidies amounted to 1500€ for single-family homes and 750€ for apartments.

Living Building Challenge A certification scheme by the International Living Future Institute, which is based on a holistic approach involving ecological and carbon footprinting.

Living laboratory The use of actual buildings, neighbourhoods, cities (or other entities) to test and analyse certain innovations or solutions. In the university context, it often involves providing students and researchers with the opportunity to experiment with different approaches and test ideas, methods and concepts on real problems.

Local Agenda 21 A global programme that resulted from the Earth Summit in Rio de Janeiro in 1992 that identified action for sustainable development at the local scale. Local Agenda 21 translated the global agenda into an action plan for cities and communities to promote environmental, social and economic sustainability.

Kreditanstalt für Wiederaufbau (KfW) Federal German government-owned development bank, offering special mortgages for home owners and real estate developers, based on KfW-defined energy standards.

Marketing See *city marketing*

Multi-level perspective (MLP) One approach to analysing socio-technical transitions. The multi-level perspective differentiates the societal context of innovations into three different levels (*landscape*, *regime* and *niche*) that provide different barriers and contexts to change.

Neobuild *Neobuild* is a subsection of the Council for the Economic Development of Construction (CDEC) in Luxembourg, focusing on green building. It conceived and operates the *Neobuild Innovation Centre* in Bettembourg, a living laboratory/showcase building where local firms experiment with building materials, technology and processes.

Net zero buildings Usually understood to produce approximately as much energy from renewable sources as they consume over the course of a year.

Niche The *multi-level perspective* understands niches as test beds for innovations and new socio-technical constellations. They usually consist of spaces that are protected from rules and structures at the higher scales of the *regime* and *landscape*.

Olympic Village A neighbourhood in central Vancouver that was built to house the athletes for the 2010 Winter Olympics. The Olympic Village is located in *Southeast False Creek*, an area that had been earmarked by the City of Vancouver

for a green neighbourhood development. Vancouver's successful bid for the Winter Olympics fuelled ambitions to make the Olympic Village a world class eco-district characterised by a wide range of green building features.

Passive house (German: Passivhaus) A voluntary international high-energy efficiency building standard. Based on highly efficient insulation and heat recovery, passive houses require an annual heating and cooling demand less than 15 kWh/m^2 which lies significantly (70–80%) below standard new buildings.

Plus energy house See *energy plus house*

Policy mobility A recent strand of literature that analyses how urban policies are developed and transferred. It focuses on how knowledge and ideas on how cities should be governed (i.e. policies) are transferred, adapted and adopted globally and are being transformed as part of this process.

Regime The meso-level of the *multi-level perspective* that describes predominant organisational standards and norms, for example, prevailing rules and conventions of an established industry.

Relational (urbanism) An understanding that cities are as much shaped by external events, broader socio-economic processes and people, institutions and ideas from elsewhere as they are by local factors such as their geography (e.g. climate), economy and society. From a relational perspective, cities are both global and local entities. See also *urban assemblage*.

Rieselfeld Covering an area of about 70 ha and hosting more than 10,000 residents, Rieselfeld is the largest district project in the federal state of Baden-Württemberg. The development process was initiated in 1994 and finished in 2010. All houses have been built as low-energy buildings. For instance, photovoltaics and solar thermal systems harness the energy from the sun in numerous homes. The urban development plan also attaches great importance to green spaces, play areas and open spaces, as well as cycle paths and pedestrianised streets. Rieselfeld especially embodies the idea of an evolutionary urban environment that successfully integrates active social and cultural aspects into its underlying ecological urban development standards through the early and consistent creation of the required public infrastructure.

Smart cities Usually understood as a city or urban area that uses different information and communication technologies to gather data on all aspects of life that are then used to manage assets and resources more efficiently.

Smart growth A development approach that promotes mixed-use, walkable and socially inclusive neighbourhoods as well as public participation to achieve sustainability.

Social city (Soziale Stadt) A development programme in Germany that focuses on the regeneration of socially deprived urban areas and neighbourhoods.

Solar settlement A plus-energy neighbourhood in Freiburg's Vauban district consisting of 59 multi-storey townhouses and a commercial building complex. Completed in 2006, the neighbourhood is a renowned demonstration project named after the photovoltaic systems installed on the roofs of the buildings.

Solarwind A private office building completed in 2012 in Windhof, Luxembourg. Named after its most visible features (solar and wind power), the complex is seen by many as best practice example of green building which involves a number of features to realise carbon neutrality.

Southeast False Creek Southeast False Creek is an old-industrial area southeast of downtown Vancouver, which was opened up for development as part of the 2010 Winter Olympics. The neighbourhood development was designed as a mixed-use community with a total population of 12,000 people, with a focus on residential housing. The *Olympic Village* comprised the first phase of the development.

Sustainability fix The alignment of sustainability measures and initiatives with economic development. The sustainability aspect of these proposals increases support for these developments and limits opportunity for opposition. It hence reduces the opportunity to resist controversial developments in political debates. Sustainability fixes have also been criticised for hollowing out sustainability objectives to favour economic growth objectives.

Sustainability transition A term used to describe a fundamental change of existing societal systems towards more sustainable forms of production and consumption or the more normative call for such a transformation.

Technocentric Focus on technology and the belief that technological innovations can effectively control and respond to environmental problems.

Technological fix The use of technological solutions to solve a problem. Critics argue that technological fixes often neglect to address systemic problems and often favour environmental and economic concerns over social dimensions of problems.

Transition management A more normative and planning oriented section of transition studies that is concerned with creating and nurturing protective spaces for innovation.

Transition region Regions at the sub-national scale that are seen as successful regional development models. Philip Cooke introduced the term in reference to regions that used eco-innovations to boost their regional competitiveness.

Transition studies A conceptual approach focuses on understanding the co-evolution of societal and technological changes in particular in respect to radical innovations.

Trope A word or expression used in a figurative or metaphorical sense that delivers a very clear image or message that is hard to misunderstand.

Urban assemblage The idea that cities consist of many bits and pieces from near and far. These pieces are in a constant process of being assembled and reassembled leading to particular forms of urbanism (urban life and form).

Urban entrepreneurialism Investment-friendly strategies and approaches by urban authorities that seek to attract investors to their jurisdiction.

Urbanism The urban design of cities and the ways of life that shape cities. The two are linked and influence each other.

Urban transition A term used to prescribed and describe fundamental shifts in the way we understand, design and make cities including all dimensions of urban lives. Historically, urban transitions were linked to technological advances such

as electricity or advances in transportation technology. Current debates on urban transitions revolve around climate friendly and socially inclusive cities.

Vancouverism An urban design approach developed in Vancouver that seeks to attract a larger residential community back into the central area of the city. Main features to improve liveability include an increase in public spaces including parks and emphasis on walkable neighbourhoods. The approach is characterised by slim high-rise buildings and recessed upper levels on low-rise buildings to increase light, views and a sense of open space.

Vauban A green neighbourhood in Freiburg developed on land previously occupied by military barracks. The development of the area started in 1993 and was completed in 2014. By 2001, the first 2000 residents moved in the district and to date, Vauban dwells 5000 people. The main goal of the project has been to implement a city district in a participatory way, which meets ecological, social, economic and cultural requirements. Low-energy building is mandatory in this district, and around 170 units have been built as passive houses and a further 70 as energy-plus homes. Heating from a local heating network powered by renewable energy sources and the use of solar technology is largely standard for most homes.

Weingarten A low-income residential district including a large share of social housing estates. The majority of the housing stock dates back to the late 1960s when around 1500 mostly publicly funded residential units were developed by the *Freiburger Stadtbau*. The district has been at the core of Freiburg's green building retrofitting initiatives including the *Buggie 50* complex.

World Café Experimented in 1995, the World Café consists of a qualitative research method within a group environment which fosters collaborative learning and constructive dialogue between participants. Participants are split across tables where a specific discussion topic is suggested by the researchers. The mix between different tables and the diversity of discussions on the various topics are pivotal in harvesting a collectively produced knowledge. The WC method is characterised by its flexibility and room for adaptation to different research and practice objectives.

Wyhl A small community located 20 km away from Freiburg where the federal government planned a nuclear power plant in the 1970s. It became emblematic for the regional environmental and anti-nuclear movement and is still often referred to by actors in Freiburg as a starting point for progressive energy policies.